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E. J. BUTLER.

EMPIRE COTTON GROWING CORPORATION

PROGRESS REPORTS FROM EXPERIMENT STATIONS

SEASON 1933-1934

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PROGRESS REPORTS FROM EXPERIMENT STATIONS, SEASON 1933-1934.

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PREFACE

The Reports from the Corporation's Experiment Stations are issued this year in a new form.

Advantage was taken of the opportunity afforded by the Conference on Cotton Growing Problems, held by the Corporation last summer, to seek the views of the large and representative body of persons who were present, as to the best solution of a difficulty that has been felt in connection with this volume ever since it was first published. The nature of the problem was set out in a Note which was circulated to the Conference before the meeting, and from which an extract is repeated here :—

" The difficulty encountered is common to reports of all applied research work, and put briefly is this :—How are the results of such work to be presented, bearing in mind the dual purpose that they are required to serve ? Thus (*a*) they must convey a clear idea of the objects and results of the work to those who probably have little or no technical knowledge of the kind of work described, but to whom the results are of sufficient importance for them to have financed it, and who are therefore entitled to have those results put before them in a form in which they can understand them.

" (*b*) They must be directly serviceable to those engaged in similar work in places other than that in which the original experiments were carried out—thus saving time and labour and unnecessary repetition.

" The Corporation have now issued their volume of Reports from Experiment Stations annually since 1923. After two years it was clear that the subject matter was both too technical and too detailed for any readers but workers on the same or allied subjects, and the Executive Committee were fortunate in enlisting the services of Dr. J. C. Willis, F.R.S., to write a preface to the volume, in which the contents of the reports were reviewed in such a way as to bring out for the benefit of the general reader the main lines that the various investigations were following and the principal results obtained. But as the Corporation's work extended, the number of Experiment Stations increased and the volume of reports grew unwieldy. The Research Committee discussed the question, and on their recommendation the several Stations were asked their views on a proposal that each Station should produce

a full report every third year only. With twelve Stations, each annual volume would thus contain four full reports. Any Station should be at liberty, however, to include between its full reports an account of any piece of work that was nearing, or had just reached, completion. In the years that intervened between the full reports, each Station should submit only a short general description, in non-technical language as far as possible, of the work of the past season, including also such tables and graphs as might be needed to illustrate the principal results, and to preserve the continuity of such records. All Stations should, further, include in these summarised reports, or in the form of a separate note if desired, any observations or results that might be of immediate use to co-workers.

" It was hoped that this scheme, in conjunction with Dr. Willis' general review as preface, would go some way towards producing a volume of reports that would fulfil both the purposes described above. The procedure has, however, only been partially successful; the authors of some of the summarised reports have evidently found a difficulty in producing the ' short general description in non-technical language, as far as possible, of the work of the past season ' —admittedly no easy matter, even to those who have had long experience.

" The question arises, therefore, as to how an improvement can be made, keeping in view the necessity for producing an annual Report that will give a clear and concise, but adequate idea of the progress made and the difficulties encountered, and also for including sufficient detail to enable workers on similar problems to gauge the value of the work and make use of its results, thus expediting progress."

The Conference were asked to make recommendations as to what would be the best form for these Reports to take with a view to " (*a*) keeping the cotton industry in touch with the Corporation's experimental work and maintaining their interest, and (*b*) disseminating information that may be useful at other Stations, bearing in mind the finding of the Milner Committee that ' Money spent on agricultural investigation and research must, it seems to us, be largely wasted if the results obtained are not fully recorded and made available to all.' "

As a result of the useful discussion which took place, it was decided to issue two separate publications, one to be a small volume intended primarily for the Corporation's own members and the general public, consisting of a general review in non-technical language, so far as possible, of the work of each of the Experiment Stations for the previous season. In this review an attempt is made to explain the relation of

the experimental work to the Corporation's general aims and objects, the advance that has been made in consequence of the work of the past season, and the return in the steady increase in the knowledge of the scientific and agricultural problems relating to cotton-growing that the Corporation are receiving for their considerable expenditure on these objects.

Secondly, each Station was asked to furnish a progress report in a form in which it would be useful both as a record of the Station's work and as providing information for similar workers on cognate problems elsewhere. Writers of these reports were requested not to include full experimental data and statistical computations, but to aim throughout at such brevity as was compatible with the purposes that the report was intended to serve. It is these progress reports that are contained in the present volume.

As will be gathered on reading the Reports, some Stations have not yet been wholly successful in devising an ideal mould into which to cast their reports, and this was, perhaps, only to be expected in a new experiment of this kind. As a guide to writers in future years, it may be serviceable to explain that it was brought out at the Corporation's Conference last year that by a progress report was meant merely a summarising of the work done at each Station in the last season alone, such as would suffice to enable other Stations to learn the kind of experimental work that is being done at each place, and the general trend of the results of the last year. It was appreciated that details of experimental procedure and of numerical results were not to be looked for in such a progress report, because they would naturally be included when, after a suitable number of years' repetition, the work was recorded in a paper in a scientific journal. It was accepted that until a piece of work had reached that stage, other Stations should content themselves with an indication of the direction in which each season's results were pointing.

In order to give effect to these general principles, it is suggested that writers of progress reports should, in future (*a*) limit the report to an account of last season's work only, with the necessary references to connect it with that of the previous season ; (*b*) give only essential features of local weather, soil, and other factors affecting growth ; (*c*) include only the main lines of the experimental procedure followed and summarize the principal results obtained. It is impossible to prescribe any specific length that should be adequate for such a report, as this must, naturally, vary with the amount of work on cotton that is carried out at the several Stations. But from experience of the reports submitted this year, it is believed that, proceeding on the

lines suggested above, 3,000 words should prove, in general, ample for a progress report.

The general review of the work of the Stations has been issued separately, and any completed pieces of scientific work that may be received from members of the Corporations staff will be submitted to the editors of appropriate scientific journals for publication there under the names of the respective authors. In the event of any such pieces of work being published, the Corporation hope to be able in some cases to purchase reprints and distribute them to members of their staff, while they would also consider the possibility of distributing them to the staffs of Government Agricultural Departments in cotton-growing countries on request.

It is greatly hoped that this new scheme for the reports will be successful in providing both the general public and workers on cotton-growing problems with such information as they wish to have regarding the progress made each season at the several Experiment Stations.

QUEENSLAND

COTTON RESEARCH STATION, BILOELA.

PROGRESS REPORT FOR THE SEASON 1933-34.

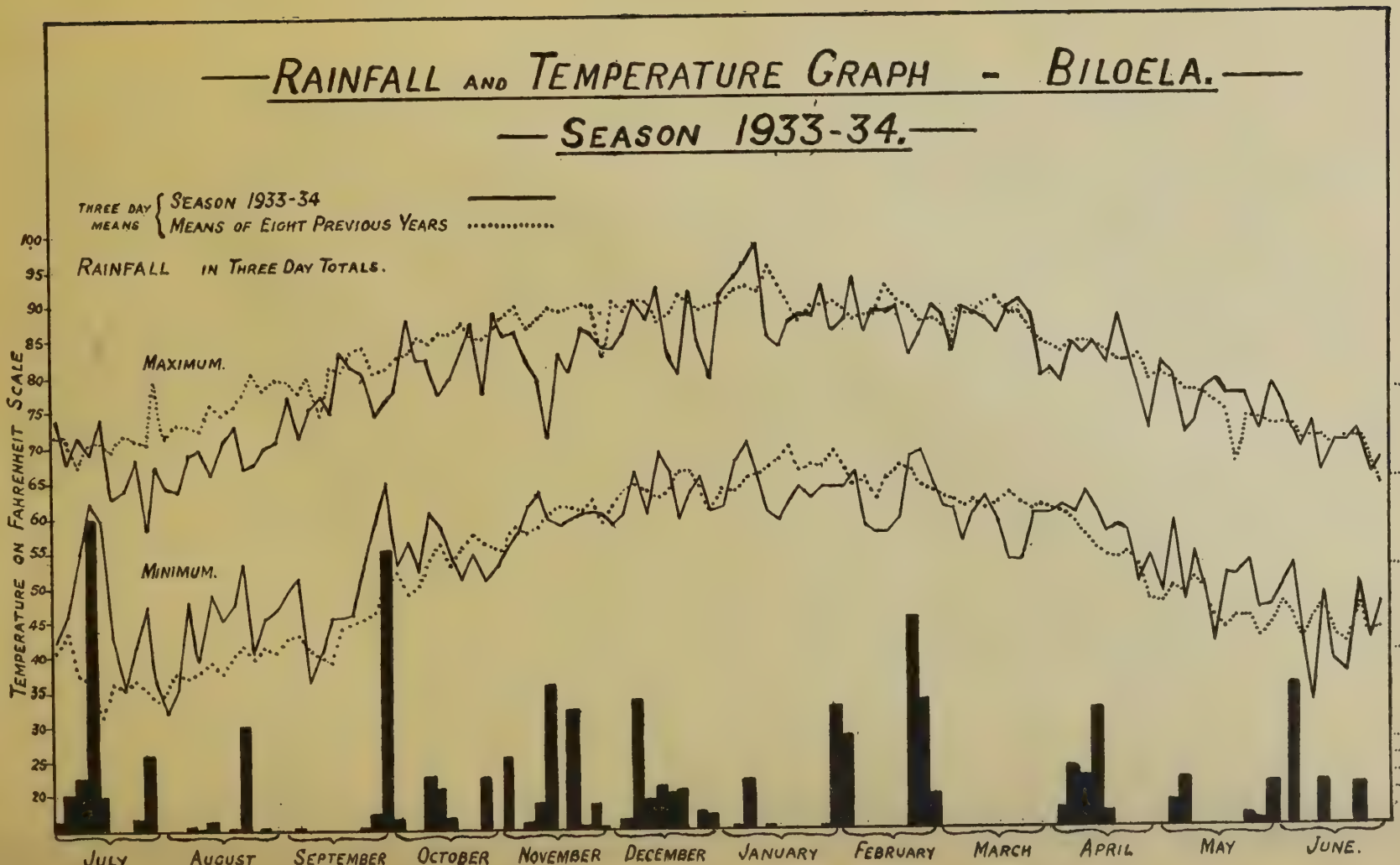
BY

W. G. WELLS (Director of Cotton Culture),
L. M. HODGE (Manager), Cotton Research Station, and
W. A. R. COWDRY (Field Assistant).

The season under review experienced exceptional winter and spring rainfall, the total from July to October inclusive, 13·18 inches, being without parallel in a 39 year record of the district. Timely rains allowed of the planting of the programme of the season in nice shape during October, and good stands were obtained. Markedly slow growth in all but the latest plantings occurred throughout the spring, however, even under satisfactory rainfall, with the result that by mid-season the plants all over the Station were much shorter than usual, but of ideal structure. While the cool weather may have assisted in causing such unusual growth, it is believed that the exceptionally low nitrate content of the surface soils brought about by the heavy rainfall was mostly responsible. A month of dry weather then further checked growth, particularly in the earlier plantings, and not only hastened the development of the lower crop, but caused some shedding of squares. Good rains were fortunately experienced in time to promote further satisfactory growth, however, with the result that the highest average return was obtained that has ever been produced on the Station, namely, 1,106 lbs. seed cotton per acre, from 56·8 acres comprising a wide range of types of experiments. Had the dry spell been of less intensity, considerably better yields would have resulted in most experiments. The rainfall and temperature graph depicts how the season was marked, as a whole, by low maximum temperatures, except in May, when above normal temperatures were experienced, which helped greatly in the maturing of the crop.

Seasonal Operations.

The work of the Station may be grouped into (i) studying the changes occurring in the soils with the cultivation of successive crops of cotton, and (ii) the effects of growing cotton in rotation with (*a*)


RAINFALL AND TEMPERATURE GRAPH - BILOELA.
SEASON 1933-34.
THREE DAY MEANS
SEASON 1933-34
MEANS OF EIGHT PREVIOUS YEARS
RAINFALL IN THREE DAY TOTALS.
MAXIMUM.
MINIMUM.
TEMPERATURE ON FAHRENHEIT SCALE
POINTS OF RAINFALL
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
500
400
300
200
100
80
60
40
20
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE.

annually planted fodder crops, and (*b*) grass of several years' establishment.

Part I.

Chemical and physical analyses of new and old cultivations indicated that growing cotton on a soil for several years in succession narrows the carbon-nitrogen ratio, reduces the nitrogen and carbon content, and tends to compact the soil, thus making it more impervious to storm rains. Soil moisture determinations made fortnightly throughout the summer and autumn months showed a definite tendency for the 10–12 inch depths of 2- and 5-year old cultivations to have more moisture than the 9-year old cultivations, whereas at the 4–6 inch level the order was reversed. There was also a quicker penetration obtained in the newer cultivations, as shown by less lag in the rise of the subsoil percentages following good rains. It was also ascertained that, even with a steady soaking rain of 2·46 inches lasting over 25 hours, 15 hours after the cessation of the rain only 35 per cent. of the total precipitation had penetrated into the 9-year cultivation, as compared with 74 per cent. in the 2-year old. The bulk of the moisture in the older cultivation was in the first 6 inches, whereas the first 9 inches in the younger cultivation was well moistened, and some penetration had occurred within the first 18 inches.

Latin Squares of five varieties covering a wide range of American Upland cottons grown on the three ages of cultivation showed marked differences in plant growth reaction to the different cultivations. Briefly, the main differences were as follows :—The mean height of each variety was the shortest on the 2-year cultivation, except in the case of the two most drought-resisting varieties ; flowering was the heaviest on the newer cultivations until the effect of the dry weather in mid-season was felt, when the oldest cultivation produced the most flowers—the total flowering for the period of observation in ascending order was 9, 5, and 2-year old cultivations ; the more open type varieties flowered the heaviest in all cultivations ; the total number of fruiting nodes for all varieties was the greatest on the 2-year cultivation ; prior to the dry spell the plants on the 2-year old cultivation shed 25 per cent. less, but, following the dry spell, 10 per cent. more than those on the 9-year cultivation ; the total yields of the experiments were, 9-year, 1,372, 5-year, 1,314, and 2-year, 1,236 lbs. of seed cotton per acre, which was in marked contrast to the previous droughty season, when the yields on the same sites were 251, 501, and 917 lbs. seed cotton per acre ; the mean of all varieties indicated a significantly lower percentage of 5 lock bolls on the 9-year than on either of the other two cultivations, with the 5-year significantly

higher than the 2-year—this would appear to confirm the findings in the soil moisture investigations, for it has been found in the U.S.A. that the amount of moisture in the soil affected the percentage of 5-lock bolls (*) ; the mean weight of 5-lock bolls was significantly heavier in the 9-year than in the 2-year, and better, but not significantly heavier, than in the 5-year cultivation. With the exception of the least drought resistant variety, there was a general tendency to produce lint of higher grade and less spot on the newer cultivations ; and all but the fullest bodied variety showed a tendency for the fibres to shorten progressively from the old to the newer cultivation. Root investigations indicated that the mean diameter of the stalks at the cotyledons was significantly less, the lateral roots developed sooner, there were more laterals in the first 7 inches, the diameter of these laterals at a point 5 inches from the main stalk was significantly smaller, and there were significantly fewer small laterals in the older than in the other cultivations. There were no significant differences between the mean lint indices for each age of cultivation ; likewise there were no significant differences in the mean number of motes and seeds per lock.

The general results in the varietal tests appear to substantiate the findings of the chemical and physical analyses of the soils of the three ages of cultivation. The older cultivation had a higher nitrate content, which would have been considerably higher through the season but for the phenomenal rainfall during its first half. The varieties of most open type of growth yielded the best on such soil, although all varieties did better than anticipated, due, it is believed, to the low nitrate content, which tended to restrict growth sufficiently to make a nice type of plant. This was true on all the older cultivations of the Station and surrounding district, where the plants were likewise remarkably smaller than usual.

Sieving tests of the nature suggested by Keen tended to indicate that the longer period of cultivation had broken down the soil into finer particles which set and then broke into clods when ploughed. This would confirm the results obtained in the moisture penetration test.

Another varietal test embracing a comparison of a more extreme nature, of types of vegetative drought resistant varieties and small boll open-growing American Upland cottons, which was conducted on 9-year old cultivation, confirmed the findings that the more open types gave the heavier yields on the older cultivations. Such types

(*) A. R. Leding and L. R. Lytton—Journal of Agricultural Research, Vol. 47, No. 1, July, 1933.

must have some degree of drought resistance, however, as shown by the failure of Mis Del No. 2, the most open type used, to withstand the dry conditions at mid-season.

Confirmation of American investigations were also obtained indicating that the slower fruiting varieties do not necessarily produce low yields, nor does the variety producing the most flowers early in the season always mature the most crop (*).

Spacing Tests.

Randomized 6 × 5 spacing tests in the Indio Acala variety comprising (1) unthinned, (2) single plants one foot apart, (3) 7 inch hoe widths of plants spaced one foot apart, (4) the same spaced two feet apart, (5) two plants spaced in hills two feet apart (the plants varying from 2 to 6 inches apart in the hills), and (6) single plants two feet apart, on 9 and 2-year old cultivations indicated a general superiority of flowering on the 9-year cultivation with the exception of the unthinned, the total for all treatments on the 2-year cultivation being 93·3 per cent. of the total of the 9-year.

The mean yield of all treatments, however, was in favour of the 2-year cultivation, which produced 11·4 per cent. more cotton. No significant differences were obtained on the older cultivation, but the tendency was for the one foot single spacing to yield the most heavily, as was the case in the 2-year cultivation, where this spacing was significantly the best. Apparently any attempt to leave bunches of plants closely spaced, or non-thinning, caused too much competition, although two plants per hill spaced two feet apart yielded better than one plant spaced the same distance on both treatments.

Studies of the lint obtained in each spacing indicated that there was no significant difference between the means for the length or body of fibre. There was, however, a significant difference in strength and drag in favour of the older cultivation, the 1 foot single spacing mostly contributing the differences obtained. There was also a significantly higher grade in the older cultivation in all treatments except 2 feet spaced bunches, where the fibre was decidedly more spotted, weaker and of softer body in the older cultivations.

Root investigations indicated that generally competition reduced the diameter of main stalk and number of large laterals in both soil types. All spacings produced more large than fibrous laterals in both cultivations, with the 2 feet doubles having significantly the fewest

(*) T. S. Buie—Fruiting Habit of the Cotton Plant. Bulletin 261—1929, South Carolina Agricultural Experiment Station, Clemson, College.

total laterals. There was no difference between the single spacings on the older cultivation, but the 2 feet singles produced significantly more laterals on the newer one.

Machine Thinning.

Machine thinning of Durango cotton was again compared with hoe thinned plants spaced two feet apart, on both 9- and 5-year old cultivations. The machine thinned plants grew much taller and more spindly with little bottom crop, although they started flowering first. They wilted much sooner in the day during the mid-season dry period, but recovered more quickly after the following rains.

The bolls on the machine-thinned plants were much smaller, but with a greater number per row the yields of the two treatments on the old cultivation were about the same. The lint of the machine-thinned was of a lower grade and more wasty, however. On the 5-year cultivation there was a significant difference of 273 lbs. seed cotton in favour of the hoe-thinning. Apparently, excess plant population was felt more on the new cultivation. This was not the case in the spacing test in the Indio Acala cotton. The difference may be due to varietal response to crowded conditions, as the vegetative branches of Durango cotton are very efficient producers.

Summary of Part I.

The results obtained in the different experiments conducted to study the effect of successive years of cultivation of cotton on a clay loam type may be summarized as follows :—

Eight successive years of cultivation of cotton starting from virgin country definitely changed the chemical and physical condition of an alluvial clay loam. These changes affected the suitability of the soil for certain varietal types, as was demonstrated by the yields obtained and the differences in plant and root developments measured. In some instances results contradictory to those obtained in past seasons were secured, but indirectly they appear to confirm the hypothesis which has been formed that the narrowed carbon-nitrogen ratio and lessened carbon content explain to a large extent, the tendency for much of the alluvial loams to have a smaller " factor of safety " for the production of profitable yields of cotton under normal seasonal conditions.

Acknowledgments are due to the Agricultural Chemist of the Department of Agriculture and Stock, and his staff, for kindly carrying out the various analyses of the soil samples.

Part II.

Rotations.—No significant differences were obtained in the regular rotation series this season, the yields all being around 1,000 lb. of seed cotton per acre.

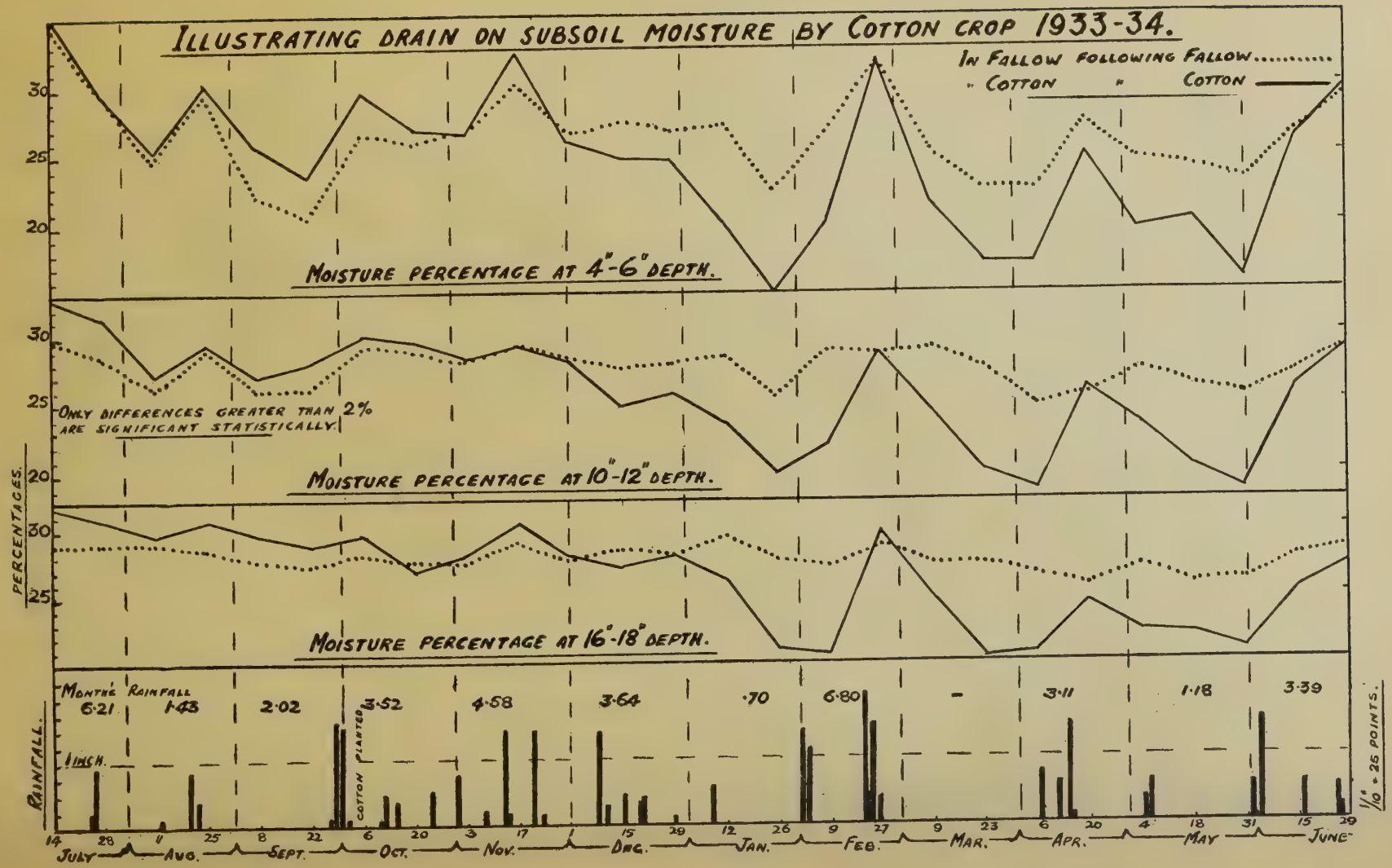
Cotton following oats following maize gave a clear cut demonstration of the effect of lack of subsoil moisture during the dry January, the yield being at the rate of only 283 lbs. seed cotton per acre, as compared with 605 lbs. for cotton following cotton, both being late plantings (7th December).

Cotton following a turn-under of matured saccaline out-yielded cotton following cotton, means of 950 compared to 859 lbs. seed cotton per acre being obtained.

The study of the effect on soil moisture of cotton following cotton as compared with bare fallowed cultivation was continued. The graph depicts the movement of soil moisture in soil that has not borne a crop for three seasons, and also depicts the drain on the moisture caused by a cotton crop.

Both early and late plantings of cotton following the fresh breaking up of a Rhodes grass sod two and a half years old, produced gains over companionate cotton-cotton plots which had grown cotton for several seasons. A definite denitrification effect was obtained in the Rhodes grass-cotton plots, as evidenced by the red stalks and light yellow leaves. The plants were also shorter. Undoubtedly, the leaching of nitrates brought about by the heavy spring rainfall seriously affected the plants, and with more normal conditions a greater gain would have been obtained. The fibre of the Rhodes grass-cotton plots tended to be of slightly lighter body and longer length, otherwise there were no differences. The root systems showed similar differences to those found in the comparison of 9- and 2-year old cultivation, excepting that there were more large laterals in the 9-year old cultivation, which may explain the increase of yield obtained in the older cultivation in that experiment.

Manurial trials of phosphates, both as top dressings and applied in furrows before sowing the cotton, failed to show any significant responses. Likewise, nitrate top dressing did not yield any significant differences. Nitrate of soda at the rate of 1,926 lbs. per acre applied as a broadcast just prior to planting had a definite effect on newly broken up virgin grass land, during the first half of the season. No differences in plant growth could be observed, however, at the end of the season, and the yields were practically the same as those of the companionate unmanured plots.


ILLUSTRATING DRAIN ON SUBSOIL MOISTURE BY COTTON CROP 1933-34.
IN FALLOW FOLLOWING FALLOW
" COTTON " COTTON
MOISTURE PERCENTAGE AT 4"-6" DEPTH.
ONLY DIFFERENCES GREATER THAN 2% ARE SIGNIFICANT STATISTICALLY.
MOISTURE PERCENTAGE AT 10"-12" DEPTH.
MOISTURE PERCENTAGE AT 16"-18" DEPTH.
PERCENTAGES.
30
25
20
MONTHS RAINFALL
6·21
1·43
2·02
3·52
4·58
3·64
·70
6·80
—
3·11
1·18
3·39
COTTON PLANTED
1 INCH.
RAINFALL.
14 28 11 25 8 22 6 20 3 17 1 15 29 12 26 9 27 9 23 6 20 4 18 31 15 29
JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE
1/10 = 25 POINTS.

Entomological Notes.

The season was marked generally by a most satisfactory absence of serious damage by insect pests, except a rather severe attack of thrips, when the secondary leaves were first appearing, and a heavy infestation of aphids during November in the showery weather. Slight outbreaks of cutworms were easily controlled by poisoned bran baits.

Corn-ear worm damage was remarkably light throughout the season, as was also the case with the rough bollworm, as compared with previous crops. The pink bollworm was noticed in fair numbers from mid-season onwards. Very heavy populations were observed in consignments of cotton arriving at the ginneries, and undoubtedly, in conjunction with the showery harvesting period, this pest was responsible for a lot of the exceptional amount of spotting of cotton that occurred this season.

Weekly and fortnightly swabbing of plant terminals with the Hill's boll weevil poison formula used in the U.S.A., while preventing some loss of terminals, failed to stop terminal loss entirely, the final significant percentage of terminals present being :—weekly application, 58·3 per cent., fortnightly, 48·9 per cent. and control, 41·4 per cent. No significant differences in yields were obtained.

SOUTH AFRICA

COTTON EXPERIMENT STATION, BARBERTON.

PROGRESS REPORT FOR THE SEASON 1933-34.

COTTON-BREEDING AND FIELD EXPERIMENTS.

BY

D. MACDONALD.

Season and General.—The salient features of the past season were (1) extremely good conditions in the early season, (2) severe drought during February and early March coupled with an American bollworm attack of almost unprecedented intensity over the whole district, (3) fair rains during the second half of March and early April followed by a very mild winter.

On the Station the rains broke on 16th–17th October, a fall of 1·40 inches being recorded, which enabled all rough ploughed land to be worked down to a decent seed bed. Further good rains fell during the first week of November, and all the cotton variety trials, selections and most of the multiplication bulks were planted between the 6th and 9th November, practically perfect stands being obtained. Good growing conditions continued until the end of January, the crop making rapid progress : the ensuing period of drought was all the more severely felt in consequence.

The American bollworm attack was so severe that the plants on undusted fields were denuded of practically all crop and, until the rains of 14th March, recovery and re-setting of crop was impossible. An attempt was made to save the crop by dusting the plants with calcium arsenate. The stock of poison and dusters in hand was not sufficient for the area of cotton attacked, and some time elapsed before they could be obtained in sufficient quantity ; eventually the whole area was dusted, but only in those sections that were treated early was a large proportion of the crop saved. As dusting is only effective in killing bollworm larvæ in the early instars it is essential that regular records of egg laying on the crop be taken throughout the season in order to be forewarned of the attack. Dusting in the above way would not prove an economic proposition in ordinary farming practice,

but is undoubtedly useful for saving small plots of valuable strains which might otherwise be lost. A drawback is that it probably kills a large proportion of useful insects like ladybirds, with subsequent increased damage by aphis.

The end of the season showed once again the remarkable powers of recovery of U.4 cotton and its re-selections, the mild winter and practically negligible stainer damage allowing all late set bolls to mature and open, so that crops of upward of 1,000 lbs. seed-cotton per acre were reaped on the Station, and similar results were obtained in the district.

In the Barberton valley individual fields of cotton which escaped bollworm damage have yielded from 1,500 to 2,000 lbs. seed-cotton per acre despite rainfall conditions similar to those experienced on the Station. The district crop as shown by the ginnery return is about double that of the previous season.

Variety Trials.—Variety trials on the Station were so badly damaged by bollworm that no reliable figures could be obtained. Fortunately the main trials consisting of U.4 Bulk and twelve other strains were also planted on two outside farms, and these gave very reliable figures.

On Mr. D. J. Arkell's farm the five leading strains, 955, 052, 9264, 998 and 921 gave yields ranging from 461 to 484 lbs. lint per acre, while the other strains ranged from 402 to 433 lbs., U.4 Bulk yielding 418 lbs. A difference of 48 lbs. lint per acre was required for significance (P=·05) and the four best strains were all significantly better than Bulk. The above yields were obtained on a light granite soil under a very moderate rainfall badly distributed, but the trial escaped bollworm damage.

A trial of the same thirteen strains was planted on Mr. E. T. E. Andrews' farm on the opposite side of the valley. This trial suffered severely from bollworm damage, but recovered remarkably well, the six leading strains, 4/4, 052, 9292, 998, 9243 and 9264 giving from 359 to 378 lbs. lint per acre against 326 lbs. from U.4 Bulk. The difference of 31 lbs. lint per acre required for significance (P=·05) showed the six leading strains to be significantly better than U.4 Bulk, while only one strain was significantly worse.

Selections.—A total of 363 special bulk and single-plant selections from U.4 strains were carried on from the previous season. Bollworm damage seriously interfered with the normal work of selection and most of the lots have been special bulked for re-testing next season.

In addition to the above, 332 crosses between U.4 and a number of other cottons of different types supplied by Dr. Harland of the Corporation's Cotton Research Station, Trinidad, were planted.

Damage by bollworm in the block of crosses was very much lighter than on the U.4 cotton area and definite progress can be recorded.

The above lots consisted of five groups of crosses :—

1. (U.4 × Jamaica Xerophitic) × Upland.
2. (Cambodia × Jamaica Xerophitic) × U.4.
3. (U.4 × Gambia) × U.4.
4. (U.4 × Gambia) × Cambodia.
5. (U.4 × Cambodia) × U.4.

With very few exceptions all the lots in the first four groups showed very great susceptibility to jassid, numbers of them being completely killed, despite the fact that it was not a bad jassid year. Most of the lots which exhibited any resistance to jassid set practically no crop or were much too late for the district.

The fifth group (U.4. × Cambodia) × U.4, however, judging from its behaviour during the past season, contains distinctly promising material for selection. The whole of this group showed a marked degree of resistance to jassid and at the same time appeared to possess very good fruiting qualities. As was to be expected, a wide divergence in habit, earliness and fruiting was observed, but the general level of what may be termed " cropping power " was so high that very few lots in the group were discarded. Large special bulks have been taken from all the lots retained.

Miscellaneous.

Fertilizer Experiment.—This experiment was started in the season 1931–32 and continued on the plan described in last season's report, with one exception. The plot, which in previous years received a dressing of 200 lbs. of nitrate of soda per acre, was converted, at the request of Dr. Mason, Cotton Research Station, Trinidad, into a plot receiving nitrate of soda 200 lbs., sulphate of potash 200 lbs., superphosphate 250 lbs.

The results given in Table I continue to bear out the beneficial effects of phosphate on the crop as shown in previous seasons.

TABLE I.

Fertilizer.	*Dressing lbs. per acre.*	*Yield lint lbs. per acre.*
P.2	500	388
KPN	200 K 250 P 200 N	382
P.1	250	337
K	200	324
NIL	—	254

Difference required for P = ·05, 66 lbs. lint per acre.

Spacing Experiment.—A spacing experiment using spacings of 6 inches, 12 inches, 18 inches, 24 inches and 30 inches in the row with

a standard 3 feet 6 inches between rows, gave no significant difference between treatments, although the 12-inch and 24-inch spacings actually gave the highest yields per acre, while the 6-inch plots suffered much more during the drought than any of the others.

PLANT PHYSIOLOGICAL WORK.

BY

O. V. S. HEATH.

INTRODUCTORY.

The plant physiological work during the past season has been continued along the lines indicated in the Introductory section of last year's report. The main work was devoted to the Rotation Experiments and Cultivation Experiment mentioned therein. Two-daily measurements of height of main stem were also made for correlation with meteorological data.

The very heavy bollworm infestation in February and March profoundly modified plant development and fruiting, in some cases making the plants so irregular that yield figures were useless for experimental purposes. This emphasised the importance of plant development records, since even where yield figures were valueless, the plant sampling data and growth observations obtained in the earlier part of the season gave information as to the effects of the experimental treatments. Plant sampling and growth observations were carried out using the methods described elsewhere*, " Scheme I " being used for the Cultivation Experiments and " Scheme II " for the Rotation Experiments.

ROTATION EXPERIMENTS.

The design of these experiments was described in last year's report. On each soil type, loam and granite, the experiment consists of two " sub-experiments ". In any given season one of these " sub-experiments " has the six rotation crop treatments while the other is completely under cotton. In the following season these treatments are reversed, cotton following rotation crops on the one " sub-experiment " and rotation crops following cotton on the other. Some of the main results obtained during the season 1933–34 are indicated below.

* Sampling and Growth Observations in Plant Development Studies on Cotton. O. V. S. Heath. Conference on Cotton Growing Problems. E.C.G.C., 1934.

Loam Soil, "Sub-experiment A.".—This sub-experiment was under the six rotation treatments (cotton, sunflowers, maize, soya beans, tepary beans and fallow) for 1933–34. All the crops made good growth except the maize. The latter had to be twice replanted and the final planting in January gave small plants which were badly attacked by streak disease.

In order to assess the drying effects on the soil of the various crops under drought conditions, samples for soil moisture were taken during the second week in March, *i.e.*, at the end of the drought. These samples were taken at one foot intervals from two feet down to five feet depth, at two positions on each of the six plots of three blocks. Mr. W. L. Fielding kindly supervised the taking of the samples for the writer. The soil moisture contents found (means of three plots) ranged from 18·0% at 2 feet to 19·3% at 5 feet for the Fallow, which was the wettest treatment, and from 13·3% at 2 feet to 15·2% at 5 feet for soya beans, which was the driest. Cotton showed 15·1% at 2 feet and 17·2% at 5 feet, while the maize showed 15·6% and 19·2% at 2 and 5 feet respectively. The interaction depth *v.* treatment was quite insignificant, *i.e.*, the differences between treatments were not significantly different for the various depths, and the increase in moisture-content with depth did not differ significantly in the various treatments. The average effect of treatment was, however, highly significant and the treatment means (of all four depths) are shown below :—

Soil Moisture %. 7–14th March, 1934. Means 2′–5′ Depth.

Fallow.	*Maize.*	*Cotton.*	*Tepary beans.*	*Sunflowers.*	*Soya beans.*	*Signif. Diff.*	
						$P = ·05$	$P = ·01$
19·0	17·9	16·2	15·4	14·6	14·2	1·2	1·8

These figures again demonstrate the extremely desiccating effect of soya beans and sunflowers on the soil (*cf.* last year's report, p. 80). The maize was so late and small as to be obviously unrepresentative of this crop, and soil samples were taken on 15th March at the same four depths in a near-by field of well-grown bulk maize. (The rain of 14th March had not penetrated to 2 feet.) The mean moisture contents obtained from these samples ranged from 15·7 per cent. at 2 feet to 18·7% at 5 feet, with a mean for all four depths of 17·2%. These figures indicate that even well-grown maize under drought conditions had removed comparatively little moisture from the soil.

Further soil moisture samples were taken from this sub-experiment in the winter (July–August) after all the crops had been removed. In this case the samples were taken at 10 inches and 2 feet 4 inches

depth at six positions on every plot of all the six blocks. The 10-inch samples showed fallow (14·2%) very significantly more moist than any other treatment, and cotton (10·8%) very significantly drier than anything else. The other four treatments did not differ significantly among themselves and averaged 12·8%. The treatment means for 2 feet 4 inches are shown below :—

SOIL MOISTURE % AT END OF SEASON. 2′ 4″ DEPTH.

Fallow.	*Maize.*	*Teparybeans.*	*Soya beans.*	*Sunflowers.*	*Cotton.*	*Signif. Diff.*	
						$P = 05$	$P = ·01$
18·0	16·5	15·1	14·6	14·3	13·4	0·9	1·2

The fall of cotton from being one of the wetter treatments in March to the position of significantly driest in July–August, was presumably due to the long continued growth of this crop (partly caused by the bollworm attack). All the other crops had nearly or entirely finished growing by 14th March.

The cotton plots gave an average yield of 880 lbs. seed-cotton per acre, which must be considered fair in view of the drought and bollworm infestation, although the latter was not so severe on the Loam Soil Rotation Experiment as on many parts of the Station.

Loam Soil. "*Sub-experiment B.*"—This sub-experiment was planted throughout with 920 S.B. cotton on 8th Nov., 1933. Germination was somewhat uneven owing to the rains on 9–11th November causing a hard crust over the seeds where the soil had been pressed down in planting. Plant samples taken a week after germination showed that the cotton seedlings on the fallow treatment were larger (as measured by total dry weight) than on any other except teparies and perhaps cotton. The treatment means and significant differences are shown below :—

COTTON 8 DAYS FROM GERMINATION. TOTAL DRY WEIGHT. GMS. PER PLANT.

Fallow.	*Teparybeans.*	*Cotton.*	*Sunflowers.*	*Maize.*	*Soya beans.*	*Signif. Diff.*	
						$P = ·05$	$P = ·01$
0·764	0·711	0·686	0·672	0·634	0·601	0·086	0·117

It will be seen that the order of the treatments is practically the same as the order for residual soil nitrates 0–9 inches depth found at the end of the previous season (see p. 81 of last year's report). This suggests that the initial superiority of the cotton following fallow may have been due to higher soil nitrate content. Residual soil moisture from the previous season was not likely to be a factor at this early stage in the plants' development, there being abundant moisture in the ploughed soil and no significant difference between treatments

at 7–9 inches depth (as shown by soil moisture samples taken 13–14 days after germination). Two weeks after germination, cotton following fallow had lost its lead, and there was no significant difference between treatments in terms of dry weight. Three weeks after germination the cotton following fallow had a very significantly lower dry weight than that on any other treatment, *i.e.*, the usual depressing effect of fallow had entirely overcome the initial advantage which may have been due to higher soil nitrate content. After this the cotton on the fallow treatment remained the smallest for a considerable period, while that on the tepary treatment was largest. The latter started to flower significantly sooner than any other treatment, being nearly six days earlier than the fallow and seven days earlier than the maize.

It was suggested in last year's report that the better growth of cotton on cropped than on fallowed land might be due to better penetration of moisture and better aeration in the former. Evidence obtained from soil moisture and soil nitrate determinations on samples taken at 7–9 inches and 2 feet during the past season is opposed to this hypothesis so far as penetration of moisture is concerned. There are, however, reasons for thinking that lack of aeration below about 2 feet may be the explanation of the depressing effect of a previous fallow on the early growth of cotton. Samples taken from "Sub-experiment A" at the end of the drought (March, 1934), and after the end of the season (July–August, 1934), and samples taken from "Sub-experiment B" at the end of the previous season (June, 1933), all gave a moisture content at 2 feet depth of 18% for the fallow treatment. Samples from "Sub-experiment B" in the early parts of the past season (November, 1933–January, 1934), gave moisture contents of about 19% at 2 feet for the fallow treatment. If the moisture content at and below 2 feet depth never falls lower than about 18% (which is very near to the "field capacity" of about 20%), there can be very little aeration of the fallowed soil such as must occur in the cropped soil. In the latter, the moisture contents at 2 feet may fluctuate between as low as 13–15% and field capacity, causing the displacement and replacement of air as the moisture content rises and falls respectively. On the above hypothesis, the better growth on the fallow treatment during the first week after germination would be checked when the roots reached the unaerated soil at or near 2 feet depth, and the usual depressing effect of fallow would then set in. Later in the season the drying action of the cotton roots would presumably gradually extend the zone of aerated soil on the fallow treatment deeper and deeper. Towards the end of a long season, therefore, the fallow treatment might well go ahead of the others by

reason of its greater reserve of subsoil moisture. During the coming season an attempt will be made to obtain evidence bearing on the hypothesis.

Pickings were carried out at fortnightly intervals beginning on 15th May. This was unfortunately somewhat late for a first picking, nearly half the total crop having opened. The yields from the first picking were highest for the cotton, maize and sunflower treatments and lowest for tepary beans and fallow, but the differences were not significant. It seems likely that had several earlier pickings been made, significant differences in earliness might have been found. The later pickings (third and fourth) gave significantly higher yields for fallow and tepary beans than for any other treatment, and the last picking (fifth) gave a significantly higher yield for fallow than for any other treatment, tepary beans included. The total yields for all pickings are shown below :—

TOTAL YIELDS. LBS. PER ACRE OF SEED-COTTON.

Fallow.	*Tepary beans.*	*Cotton.*	*Soya beans.*	*Maize.*	*Sunflowers.*	*Signif. Diff.* $P=\cdot05$	*Signif. Diff.* $P=\cdot01$
1,046	1,045	884	776	735	685	176	239

It will be seen that the fallow and tepary beans gave significantly higher total yields than any other treatment except cotton. These were the two treatments that gave the main part of their yields in the later pickings, and this appears remarkable in view of the fact that as regards early growth and flowering the tepary beans was the earliest treatment and fallow one of the latest. The explanation is probably that the bollworm attack was heaviest on the tepary bean treatment where the cotton plants were biggest and most advanced and therefore most attractive to the laying moths. This heavier attack, if it occurred, would prevent the tepary bean treatment from giving the earlier yield which might have been expected in the absence of bollworm. Later in the season after the main bollworm infestation had passed off, the fallow and tepary bean treatments went ahead, presumably owing to their greater reserves of subsoil moisture (*cf.* p. 80 of last year's report), and, thanks to the long and mild finish to the season, gave the highest yields.

Granite Soil. "Sub-experiment A."—This sub-experiment was under the six rotation treatments for 1933–34. All the crops made good growth except the maize, which was twice replanted and was therefore late and small. Although the bollworm attack was very heavy, the cotton plants recovered well afterwards and the plots yielded 948 lbs. seed-cotton per acre.

Granite Soil. "*Sub-experiment B.*"—This sub-experiment was planted throughout with 920 S.B. cotton on November 9th, 1933. Excellent germination gave practically full stands all through. Plant sampling and growth observations showed that on and after 17 days from germination the cotton on the sunflower treatment was significantly smaller than that on any other throughout the early part of the season. Although fallow was not one of the best treatments, there was but little indication of a definite depressing effect of fallow such as is found on the loam soil. Until more data have been obtained for the granite soil it is premature to discuss this, but it may be mentioned that the granite soil is very coarse in texture and therefore less likely to suffer from lack of aeration than the loam. The bollworm attack was very severe ; on many of the plots the plants were completely stripped, and they became so irregular that growth observations had to be discontinued. The plots were not picked separately on account of this great irregularity.

Cultivation Experiment.

The general design of the Cultivation Experiment for 1933–34 was similar to that described in last year's report, except that the three treatments were laid out in five randomised blocks instead of four. The Compressed treatment was effected as follows :—After the whole experiment had been harrowed and cultivated to give the Normal treatment, the Compressed plots were harrowed once with a tandem-disc harrow set straight. They were then further compacted by running the caterpillar tractor up and down the plots so that the tracks were only separated by about 3 inches. The plots were then again harrowed with the tandem disc slightly set, so as to break up the cakes of surface soil made by the track or tracks. The Grubbed treatment was effected by the same large rigid tyne semi-grubber cultivator, inserted to 8 inches depth, as was used in the previous season.

The whole experiment was planted with 920 S.B. cotton on 6th November, 1933, and excellent germination gave practically full stands on all treatments. Plant samples showed, that on and after 22 days from germination, the cotton on the Grubbed treatment was significantly smaller and later than that on the Normal and Compressed treatments until mid-February. After this the plants became very irregular owing to the bollworm infestation. Probably owing to this effect of the bollworm, the plot pickings showed no significant effect of treatment either on earliness or on total yield.

The effects of the treatments on penetration of soil moisture and on soil compactness as measured with a recently described apparatus*

* O. V. S. Heath. Emp. J. of Exp. Ag. II, 1934, pp. 205–212.

were investigated. Discussion of the results obtained will be postponed until the experiment has been repeated in several seasons.

TWO-DAILY MEASUREMENTS OF HEIGHT, ETC.

In continuation of the work of previous seasons, 2-daily growth measurements and observations of " stages " on 40 plants, and daily flower counts on 120 plants were carried out on 920 S.B. cotton for correlation with meteorological data. The measurement of " stripped " plants (see last year's report, p. 51) was not carried out for 1933–34. Three years' data for " stripped " plants are already available but there has not been time as yet to work these up in full. Until this has been done, the collection of further data for " stripped " plants will not be attempted. Discussion of the results from 2-daily measurements will be postponed for the present.

INSECT WORK.

I. INVESTIGATIONS ON THE AMERICAN BOLLWORM OF COTTON.

BY

F. S. PARSONS.

The report on bollworm investigations submitted to the Corporation last year, gave an account of the work since it began in 1930, and up to October, 1933. In that Report, and in a later more detailed publication†, particulars were given of a system of continuous field survey of bollworm activity that had been inaugurated at Barberton, with a view to intensive study of the actual course of infestations of cotton and other food plants, the pest food-plant relationships, and other associated factors. The information supplied from the survey in 1933, the first year of full operation, has aided interpretation of the problems underlying bollworm control, and clearly points to a continuation and expansion of this field of endeavour. The work on bollworm for the past year has been concerned largely with improvements in the methods of survey, training of additional staff, and extension of the organization for pest recording to other areas in South Africa, as indicated below.

Extension of Cotton Pest Survey.—In the programme for 1933–34, provision was made for bollworm and stainer records to be taken in Swaziland and the Magut area (Zululand), where conditions, climatic

† Bull. Ent. Res. Vol. XXV, Pt. 3, Sept., 1934.

and otherwise, differ from those in the Barberton Valley. The insect pest work in these other districts is being carried out on identical lines with that at Barberton.

It was possible to complete all arrangements in time for the commencement of work in Swaziland and Zululand last November. Opportunity was thus afforded to record events during the whole of the rainy season and the work is now well established.

The activities of the recording staffs at each point are co-ordinated closely, and contact with workers at Barberton is maintained through the medium of frequent reports whereby the data from all the areas under examination may be compared and annotated in a continuous manner within each season.

During the year the author visited Southern and Northern Rhodesia on two occasions to discuss cotton pest investigations with Corporation workers at Gatooma and Mazabuka where, as previously reported, the same methods of bollworm survey have been adopted. In addition, Mr. Bebbington visited Barberton from Mazabuka in the early part of the season to discuss pest work. It may be stated that the exchange of visits and views has resulted in collaborative effort that has already proved of distinct mutual value, particularly as the problems in the different territories are found to exhibit similarities at many points.

American Bollworm Infestations in 1934.—Exceptionally heavy attacks of this bollworm have been experienced during the past year. In the case of Barberton (the De Kaap Valley) extensive breeding of the bollworm had been recorded in the winter-irrigated vegetable crops and citrus orchards (*vide* previous Report), and it was expected that this would result in unusually large flights of moths to the succeeding rain-grown crops. This was the first year of *continuous* field records, however, and there were no data for comparison. On a lesser scale the same conditions probably existed at Magut, as the survey party, on arrival there in November, found a heavy infestation in progress on irrigated maize.

Both at Barberton and Magut the winter and spring conditions undoubtedly favoured bollworm breeding, and this was magnified to a very great extent by subsequent breeding on natural food plants in November and December. The most important of these natural food plants appeared to be common weeds in cultivated or formerly cultivated lands, being mainly species of *Amaranthus, Chenopodium* and *Physalis* that sprang up in extreme abundance in the early spring under conditions of rainfall especially favourable to weed growth. Plants of all ages were represented in this growth, and flowering in quantity was continuous for several weeks ; thus the food plants in the

weed areas were attractive to the moth over a long period. (The American bollworm moth lays eggs on its food plants during their budding and flowering stage.)

There is little doubt that the cumulatively large numbers of moths emerging in the irrigated lands, as known from records in the case of Barberton, oviposited on the weeds, and the combination of circumstances paved the way for the later epidemic attacks on cultivated crops.

In the De Kaap area the December and early January egg-laying on cultivated crops was moderately light and much like that recorded in the previous season. Late in January, however, a great increase in egg-laying was noted at all points of record simultaneously. Moth flight from the weed breeding areas and late irrigated crops was expected at this time. This was the commencement of the heaviest attack of American bollworm that has been experienced for eight years.

In several instances in the De Kaap area the January egg-laying was the only really heavy one, but in others a February and a March–April infestation of even greater magnitude occurred. These phenomena seem to be accounted for by the fact that at some points, notably the Cotton Station, the crops suffered severely from moisture shortage and were in a wilted condition during the period in February and March when moths produced from the January larvæ were emerging. It would be contrary to our experience to find bollworm eggs in any quantity on plants in this wilted condition. Elsewhere in the district, where moisture conditions were less stringent, second and third attacks materialized in accordance with anticipated times of moth emergence from the earlier broods of larvæ.

The course of infestation at Magut was similar to that at the points near Barberton where better rains fell, although the dates of oviposition in the two areas differed somewhat. At Magut the first extensive laying was recorded in December. This was expected, as, when the author visited Magut in November to discuss operations with members of the newly-constituted survey staff, plant growth in general was found to be much in advance of that in the De Kaap area, and large numbers of late instar larvæ had already been bred. Altogether, the circumstances conduced to an attack on the earlier rain-grown crops in this district as soon as they began flowering in December. There were two later heavy attacks. These occurred when expected according to calculations on the duration of larval and pupal stages in preceding broods. At the highest figure, the egg-laying on the Cotton Station, Barberton, was four times greater than that at the Cotton Station, Magut.

The experience reported from the Bremersdorp and the Umbelusi districts in Swaziland was quite different. There no bollworm breeding could be found until mid-December. Irrigated areas of winter season crops were not present to promote bollworm breeding, the spring season was later than at Barberton and Magut, and the rains less favourable to the growth of natural food plants. In comparison with other districts, the infestations reported from Swaziland were light throughout the season, especially so at Bremersdorp.

It may be explained here that one of the objects of the survey is to determine, if possible, whether the bollworm of a district is district-bred, or whether inward migration of moths also takes place. If it is district-bred, the accumulated information from continuous survey work should prove of greater and more immediate value in crop management and other measures for control. " District " in this case should be taken to mean an area where agriculture is carried on in the same general neighbourhood, and one that is removed, as is common in South Africa, by relatively long distances and often natural barriers from other cultivated tracts. Magut and Bremersdorp are fairly good examples of this. The Barberton, or De Kaap Valley, where cotton is a principal crop, cannot, however, be considered by itself from the viewpoint of pest work because of other valleys and areas nearby, where large extents of orchard and annual crops are grown, most of which are important food plants of the bollworm. However, all the agricultural portions around Barberton, taken together, form a large district in the above sense.

It would seem from the data on the course of infestations during last year, that the variation in bollworm incidence experienced in the three districts was due to differences in the opportunities for winter and spring breeding within each of them. The suggestion that the moths were district-bred on these occasions is supported by observations on bollworm activities in outside districts as follows :—On the high veld regions above and bordering the cotton-growing districts, considerable quantities of maize are grown annually ; maize, in fact, comprises the principal, if not the sole crop. It is attacked by American bollworm and it has frequently been suggested that moths produced there find their way to the cotton farms. The circumstances of the time and quantity of breeding in this maize were noted last year at various points on the high veld west of Barberton and similarly by the Magut survey staff in their neighbourhood. In brief, the facts observed were that the early-flowering maize was practically free from bollworm, whereas the later crops were quite heavily infested, but this occurred some weeks after the first infestations of epidemic

proportions had been experienced in the low veld or cotton districts. It is not improbable that on this occasion the high veld infestation was due to moths flying out of the cotton districts. In future it is hoped to examine the high veld situation each year. It has become a much simpler matter to record bollworm on the crops in question, owing to the newly-acquired knowledge that the moth oviposits on maize over the tassellation period. Besides reducing the period of observation, this allows of the accurate dating of infestations, which can then be followed in relation to events on cotton farms.

Comparative Oviposition on Food Plants.—It was noted in 1933 that where cotton and maize were grown nearby, the bollworm moth exhibited a strong tendency to oviposit on the maize rather than on the cotton. Eggs in quantity were laid on maize only over two to three weeks in the life of the plant when the male flowers extrude and ripen, but in several of the recorded instances a succession of three and more crops of maize had been sown at such intervals of time that flowering plants were present for the greater part of the season. The American bollworm moths practically confined oviposition to these successive crops, and cotton escaped all but a very minor infestation. Some occurrences of this kind were discussed and illustrated in the report published last year, and attention was drawn to the possibilities of making use of the bollworm-maize association in planting programmes. At the same time it was pointed out that study of the habits of the moth in relation to its numerous food plants had only begun, and, amongst other things, we had yet to learn whether the moths, when particularly abundant, would still lay on tasselling maize to the extent that cotton escaped severe damage. This point was tested well in the season under review.

Judging from the comparative numbers of eggs laid on maize and cotton, the preference for maize in tassel was again strongly exhibited, but in many cases the actual number of eggs placed on cotton more than sufficed to produce a thoroughly destructive brood of larvæ. This happened in certain instances where all the circumstances, as we know them, were most favourable to testing the value of maize as a trap crop for American bollworm.

The above remarks refer, however, to the periods of heaviest egg-laying, and particularly to conditions near Barberton in late January, when a sudden very large increase in laying was reported at all points. Although maize failed to protect the cotton adequately at these times and other measures were resorted to, as stated below, its trapping value was markedly demonstrated in many other cases where the moths were apparently less numerous. In these other cases

the egg counts were of the same order as the largest encountered in the previous year's work, and the pertinent data from records on both cotton and maize confirm those of 1933. The present evidence suggests that unless the moths are unusually numerous, their attraction to maize is sufficiently strong to divert their attention from cotton, and the situation with regard to utilizing maize for bollworm control remains hopeful, as we have not had an infestation like that of the past season for eight years.

Some particular instances of the apparent failure of maize to attract may be commented upon. These were associated with wet cool weather or damage to the crops by locusts. In the former case, the attractive factors appear to have been suppressed, and possibly counteracted by frequent rain. In the latter case, crops that had the foliage stripped by locusts once or oftener did not prove as attractive if they ultimately put forth fresh growth and came into flower. Both these occurrences may be explicable on chemical grounds. Examination of all the egg records and notes on plant development in maize crops indicates that the association of the moth and the plants occurs only when tassellation is in progress and to obtain the best results a series of plantings should be designed to provide overlapping flowering periods.

The part played by weeds and other natural food plants has been referred to. It is clear from the evidence presented in the past season that these have not been under due consideration. They undoubtedly provide important breeding grounds under certain conditions. In the past year their importance lay in the fact that they bridged a gap between the late winter and early summer host crops. Their importance was emphasised because the winter season favoured an early start of breeding that increased unchecked until winter crops ripened, moths then laying on the abundant flowering weeds, as cultivated crops were still very young.

Among the weeds, the moth showed a preference for laying on *Physalis* spp., and in fact Mr. Hutchinson, who is in charge of the cotton pest survey in Swaziland, reported a well authenticated instance of the moths laying on this weed rather than on adjacent maize in fresh tassel at the time.

Sorghum, hyacinth bean (*Dolichos lablab*), and soya beans, groundnuts, sunflower and tobacco, all received particular attention in the recording on food plants in the cropping programmes of the several districts. It is hoped to find in varieties of sorghum a substitute for maize as a trap plant, particularly amongst those of a freely tillering habit, such as Mapira. This variety produces a succession of flowering heads over several weeks, that might serve to attract the moth strongly.

The initial work with sorghum in this respect, however, has proved disappointing, particularly as it is a prominent crop in the native agriculture of Swaziland. On the other hand, further data on the relations of the moth to tobacco, groundnut and bean crops (the latter as green manures) indicate that these food plants have a greater attraction to the egg-laying moth than seemed to be the case from former observations. Circumstances now permit of examining these subjects closely in the districts where the various crops are grown to any extent.

Insecticides.—The commencement and progress of the January egg-laying on cotton at the Experiment Station, Barberton, was known from the twice-weekly records taken in routine survey work. Calcium arsenate dust was applied to the cotton, with a view to destroying the larvæ while still in the early stages of growth, when their habit is to move about the plant, taking food from the plant's surface ; in the later stages they feed more interiorly, and are less likely to imbibe poison. As the dates of egg-laying were known, applications of the insecticide could be timed so as to deal with the *young* worms. The dusting was not carried out as for an experiment, and the quantities applied and other factors received no special consideration. It is of interest to note, nevertheless, that where the dust was applied in due time the results were highly satisfactory. As the surveys are continuous, warnings can be given of high egg counts from many points of record, thus allowing opportunity to apply insecticides at the most favourable time. It is also expedient to conduct experiments on this matter.

Bollworm Breeding—Winter Season of 1934.—Reports have been received of an extremely heavy infestation of vegetable crops and citrus in the whole of the Barberton district, and from Magut. As the nature of the rains in the early part of the coming season is likely to be a determining factor in the carry-over of bollworm from the winter breeding areas, it remains to be seen whether another and worse American bollworm year is to be experienced in the season 1934/35.

Parasite Investigations.—The work on the egg parasite, *Trichogramma lutea*, was concluded at the close of last season with trials of the Rhodesian strain, as referred to in the previous report. The strain was multiplied and released in an extensive experiment under favourable conditions. The results were again unsatisfactory, and attempts to utilise laboratory-bred *Trichogramma* have been abandoned. It is hoped to publish the results of the four years' work on this parasite shortly.

II. Investigations on Cotton Stainers and Internal Boll Disease.

BY

E. O. PEARSON.

The present report covers the work carried out from the commencement of the season in October, 1933, to August, 1934.

Distribution of Wild Host Plants of the Stainer.—Survey work initiated in the previous winter was extended during the winter of 1934, when a reconnaissance was made of the whole of Swaziland north of the Usutu River, the Lebombo Mountains from the north-east border of Swaziland southwards and the coastal belt of Zululand from the Portuguese border to the Umfolozi River.

Sterculia murex was found to be almost entirely confined to the basin of the Lomati River, in northern Swaziland, between 1,500 and 1,800 feet. It occurs in orchard bush country, under a rainfall of 30–40 inches, the plant association being similar to that in which the species occurs farther north, in the Eastern Transvaal. Nymphs of *D. nigrofasciatus* and *D. intermedius*, the former largely predominating, were found feeding on last year's seeds in sheltered positions below the trees at the end of June and from native information it seemed almost certain that this species of Sterculia provides a breeding place here for stainers all the year round. In this connection it may be mentioned that from March onwards collections of *D. fasciatus*, *D. nigrofasciatus* and *D. intermedius* have been made at frequent intervals throughout the winter by Mr. Allan, of Bushbuck Ridge, Eastern Transvaal, from colonies of *S. murex* visited last year. The trees found in Swaziland occur in compact colonies of up to two dozen individuals, and though the species must be regarded as a comparatively rare one, requiring very special climatic conditions, it must be considered to be locally, at any rate, of great importance.

Sterculia Rogersii appears to find its upper limit of distribution in Swaziland at about 1,500 feet. In the portion of the country covered during the present winter it has been found practically wherever suitable habitats, in the shape of low stony ridges or kopjes, occur below that altitude. In the Lebombo Mountains it occurs on the steep and rocky south sides of the several poorts where rivers penetrate the range. It has not, however, been found west of the Lebombos in Natal. It is present, though not abundant, on the lower eastern slopes of the Lebombos. Further east of this range, in the extreme north of Zululand, it has been found in very large numbers on a belt

of deep red sandy soil, derived from underlying metamorphosed sandstone, running north and south. This differs rather markedly from the usual habitat and in this situation a large proportion of the trees were extremely early in their fruiting. They were carrying, when seen in mid-July, a heavy infestation of *D. fasciatus*, *D. nigrofasciatus* and *D. intermedius*, which had evidently been breeding there for some time. The diversity in time of fruiting amongst the trees here may be an unusual occurrence, but meteorological data do not show the season to have been peculiar and it seems likely that stainers may normally have here ample facilities for winter breeding. Probably similar stretches of country occur farther north in Portuguese territory.

No host plants of importance occur between this belt of country and the coast. There, however, a species of *Thespesia* (*T. populnea var. acutiloba ?*) is common on the fringe of the thick coastal bush and *D. nigrofasciatus* was found in July, breeding on last season's fallen capsules. *D. nigrofasciatus* was also found on *Hibiscus tiliaceus*, the tree Hibiscus, which is abundant along the banks of brackish creeks on the coast from the Cape Province to Delagoa Bay and probably farther north. On account of the well distributed rainfall of the coast and the somewhat indeterminate fruiting period of these species, they probably provide a constant breeding ground for stainers.

In addition to the information derived from the winter survey work, periodical examinations have been made in the baobab belt of the Northern Transvaal, both by Mr. Botha, the Game Ranger of the Kruger National Park, stationed at Punda Maria, and, with the permission of the Chief Forestry Officer of the Union, by the Forest Officer at Louis Trichardt, with the result that *D. fasciatus*, but no other species, has been found breeding on baobab seeds from February onwards throughout the winter months.

Stainer Records on Sterculia Rogersii in the Barberton District, 1933–34.—Observations were made at fortnightly intervals on a number of colonies of *S. Rogersii* in the Barberton district, starting in August, 1933, and continuing until no more stainers were to be found on the trees. The season was marked by the production of an early crop on a small number of trees, which induced a migration of adults of *D. nigrofasciatus* and *D. intermedius* somewhat earlier than in the previous year. A large main crop of fruit was set, but this was very heavily infested with the moth larva noted in previous years, which caused premature opening and heavy loss of seed, chiefly due to mould set up inside the fruit capsules following puncturing. *D. nigrofasciatus*, *D. intermedius* and *D. fasciatus*, the last in small

numbers, continued to migrate to the prematurely opening main crop, and a fairly large F_1 generation of adults resulted in the latter part of December and early January. Had the main crop of fruit been undamaged, a very large F_2 generation might have been expected to mature during February, but the almost total loss of the main crop prevented this, nymphs of the F_2 being comparatively scarce, and the trees were almost devoid of stainers in February. The situation thus resembled that of the previous season and the subsequent invasion of cotton was likewise small.

Stainer Records in the Crop.—Systematic records of the stainer infestation in the crop have been taken during the 1933–34 season at six points in the Barberton district, at five points in Swaziland, and at three points in the Magut, Natal, district.

Collections of adults and 5th instar nymphs have been made weekly according to a uniform system designed to yield data as to the statistical significance of the population figures obtained. Using this method, differences in population of a sufficiently small order for practical purposes may be shown to be significant.

At all points the general level of infestation was about the same as in the 1932–33 season. *D. nigrofasciatus* was again the most numerous species throughout the season, but, except on one farm in Swaziland, where late in the season it reached the unusually high peak population of 19,000 adults per acre, the population was not of serious dimensions, other maxima being under 4,000 per acre. *D. intermedius* again occurred only in small numbers in the Barberton district and was rare elsewhere, whilst the numbers of *D. fasciatus* were everywhere the lowest since records have been instituted. Occasional specimens of *D. superstitiosus* were taken in all districts. This is the first record of the species south of Rhodesia.

In conjunction with stainer population records, crop records have been taken weekly, consisting of a count of flowers and split bolls on the sample row lengths used for stainer collections. From these it is clear that migration to the crop commenced at the same time as, or slightly earlier than, the commencement of boll opening. All species of stainers appeared at about the same time, and in no case was there a migration during the early and the main flowering period, such as occurs in the case of *D. superstitiosus* in Northern Rhodesia and Nigeria. The peak production of adults and nymphs, of mixed F_1 and F_2 generations, consequently did not occur until well after the peak of the bolling curve, which probably accounts to some extent for the small percentage of staining observed. Estimates of this were obtained from collections of split bolls taken from rows adjacent to

those used for stainer and crop records, these collections subsequently being graded against standard sets of four arbitrary grades of staining.

Experiments on the Transmission of Internal Boll Disease.—Experiments were carried out in which sterile bolls were exposed to nymphs of *D. nigrofasciatus*, collected on the Station, of the 2nd, 3rd, 4th and 5th instars separately, and examined after a short incubation period. Bolls exposed to 2nd and 3rd instar nymphs, though freely punctured, developed no disease in association with these punctures, whilst those exposed to 4th and 5th instar nymphs developed heavy infections of both *N. gossypii* and *N. coryli*. The experiments were on a small scale and require confirmation, but they suggest that early instars are either incapable, for physiological reasons, of harbouring the disease, or else that these instars, feeding largely on exposed seed in open bolls, are less likely to pick up the disease in a viable state than are late instars feeding on the interior of unopened bolls.

In connection with the susceptibility to *Nematospora* of bolls of different ages, a series of inoculations was carried out in which parallel samples of sterile bolls derived from flowers of the same day were taken at weekly intervals and inoculated in every lock with standard spore suspensions derived from 7-day-old sub-cultures of *N. gossypii* and *N. coryli*, using sterile distilled water as a control inoculation. A further sample of these bolls was also taken weekly on which growth measurements and moisture content determinations were made. The inoculated bolls were examined at maturity and the individual locks weighed and graded for staining, bulk tests of ginning percentage being made on the whole groups of bolls inoculated at different ages. With both *N. gossypii* and *N. coryli* the percentage of staining at maturity was high in the case of bolls inoculated when one to three weeks old, declining rapidly as the age at the time of inoculation increased up to seven weeks, after which point it remained low. The bulk of the bolls opened when between nine and ten weeks old. The loss in weight of lint due to disease, estimated as a percentage of the weight of lint in the control bolls, declined in a similar manner with the age of the boll at the time of inoculation. The full data from the experiment are not yet available, but it is clear that bolls inoculated with *Nematospora* before reaching their mature size (at three to four weeks old) represent a total loss, but that subsequently the amount of damage done diminishes rapidly as the age at the time of inoculation increases.

Rotation Crops.

BY

W. L. FIELDING AND M. F. ROSE.

Beans.—Soya beans were again planted in mid-December, and tepary beans in early January, each crop yielding at the rate of 900 to 1,000 lbs. per acre, about the average yield to be expected with the type of rainfall which has occurred over the past few seasons.

The main investigations have been into the question of suitable spacing for soya and tepary beans. A series of single-plant selections and newly introduced types of soya bean continue to be grown, but so far none of these shows definite promise of giving any appreciable advantage over the Yellow I type, for general use. Lima bean (*Phaseolus lunatus*) was discussed fully in last year's report. Whilst giving a fair yield on occasions, it has always proved an uncertain cropper, and this season a bulk of the strain grown here since 1929, planted on three different dates, completely failed to set a crop. The five strains recently introduced from Burma also proved failures. It seems that lima beans are unsuited to Barberton conditions and work on them will be discontinued. Sugar and mung beans, mentioned in the last report as of little likely use, again grew poorly and will also be discarded from the range of crops under observation.

Soya Bean (Glycine max) Spacing Trials.—Two dimensional spacing trials were again planted on both granite and loam soils, the actual range of spacing treatments being identical with that used last year. On granite there was an apparent advantage with the wider spacings. The loam experiment showed an advantage with the closer spacings, although the stand was so damaged by white ants that little reliance can be placed on the figures. It is noteworthy that the yield of 930 lbs. per acre from the bulk crop, planted at the now usual spacing of 2 feet 8 inches between rows and 3 inches to 4 inches between plants in the row, compares favourably with the best yields obtained from the spacing experiment.

Tepary Bean (Phaseolus acutifolius) Spacing Trials.—In two-dimensional spacing trials on both granite and loam soils during 1932–33 and 1933–34, a spacing treatment of 12 inches between rows and 6 inches between plants in the row has given the highest yield in four separate randomised block experiments, this superiority over all other treatments being significant in three cases out of the four. The planting of a crop with rows 12 inches apart would not be easy for the practical farmer in this district, his sole planting machine being usually of the two-row cotton planter type, and the purchase of some

form of multi-coultered drill would be necessary. The introduction of an inter-row spacing treatment of 18 inches into future experiments might give useful information as it would be possible for a farmer to plant at this spacing by setting his machine with coulters 36 inches apart, and running back between already planted rows. Such a crop could not be cultivated easily, however.

The most practical spacing included in the present trials, 36 inches by 4 inches, is very significantly below the 12 inches by 6 inches in all four trials, and a spacing of say 36 inches by 2 inches or 32 inches by 3 inches, giving 72 or 96 square inches of soil area per plant, would seem to be suggested. This suggestion is, however, somewhat negatived by the results from a fifth trial with tepary beans this season, where the inter-row spacing was 32 inches throughout, with treatments of 2 inches, 4 inches and 6 inches between plants in the row, treatment effect proving insignificant. The yield of about 990 lbs. per acre obtained from all three spacings was almost identical with that obtained from the 12 inches by 6 inches spacing in the two-dimensional spacing trial on loam soil. In experiments with a constant inter-row distance of 32 inches, carried out in the 1930–31 and 1931–32 seasons, no significant difference was found between 6 inches and 8 inches, or between 4 inches and 8 inches inter-plant spacings.

Further experiment will be necessary before anything definite can be said on the question.

Maize.—For early-planted maize the season proved one of the best yet experienced, a yield of 3,000 lbs. (or 15 bags) per acre being recorded from one lot. In later-planted maize the Streak virus was particularly prevalent, making possible an even clearer differentiation of the susceptibility of various strains than in previous seasons.

Variety Trials.—Trials were planted on granite and loam soils on different dates during the season. Each trial included some or all of the five promising varieties of which details were reported last year. Each variety was planted at two different inter-plant spacings within each experiment, the inter-row distance being 3 feet throughout. The variation of spacing treatment was introduced more with the idea of giving a fairer comparison between varieties than with the purpose of finding optimum spacings for each strain. Thus with the small, early maturing Peruvian maize planted at 12 inches and 18 inches, and the larger Hickory at 18 inches and 24 inches, a better comparison between the two strains was provided than if they had both been planted at the same spacing. It is hoped, however, that useful information on the spacing may accrue when the trials have run for a few seasons.

The first trial was planted very early (17th November) on loam soil. All varieties did exceptionally well, yields ranging from 3,117 lbs. per acre down to 2,693 lbs. per acre. Arkell's Hickory (18-inch spacing) topped the list, with Anveld (18-inch spacing) second, and White Flint (24-inch spacing) third. It is interesting that under practically ideal conditions the shorter period strains, White Flint and Anveld, were not significantly lower yielding than Hickory. This trial was practically free from infection with the Streak virus.

A second trial on loam soil was planted on December 4th. The short period Peruvian Yellow maize (18 inches) yielded 1,963 lbs. per acre, this being significantly higher than all other varieties. Peruvian Yellow (12 inches) was second, followed by Anveld (24 inches), White Flint (18 inches) and Hickory (18 inches).

In a trial planted on December 4th on granite soil, Arkell's Hickory (18 inches) was best with 2,025 lbs. per acre, followed in order by Peruvian (18 inches and 12 inches), Hickory (24 inches) and White Flint (18 inches). The latter was significantly lower yielding than Hickory (18 inches). Infection with Streak virus disease was considerable in this trial, the White Flint suffering severely in comparison with Hickory and Peruvian.

The outstanding feature of this season's work on maize is the way in which the Peruvian strain has vindicated claims previously made for it as a drought and Streak resistant type. Arkell's Hickory again showed a good degree of resistance to Streak disease, whilst White Flint appeared particularly susceptible to the virus this season. A large number of single-plant selections, which appeared to be immune to Streak disease, were taken in White Flint, and will be planted out in progeny rows in the coming season.

It should be noted that the longest period maize used, Potchefstroom Pearl, whilst giving a fair crop in the early planted trial, behaved poorly throughout in comparison with the shorter period types, especially in later planted trials. Anveld showed more promise than in previous seasons.

Sunflowers.—Variety trials with sunflowers have been discontinued, the St. 3 strain being considered well suited to requirements. Details about this strain and the spacing of sunflowers, on which question work has also been discontinued, were reported last year. Observation plots of a range of new types obtained from Russia, and of some single plants which were selfed in 1931–32, have been continued. Of the former group none appears of outstanding interest, though as this crop has been noted as particularly subject to " place effect," some lots will be worth growing again next season. Of the selfed lots several showed

a very marked uniformity within the strain in height, size of head and ripening. As unevenness of ripening frequently makes the harvesting of sunflowers difficult and entails considerable loss of grain through shedding, the latter observation is very important. The production of a new bulk of the St. 3 strain, by selfing, would seem worth while and will probably be attempted in coming seasons.

Groundnuts.—The Barberton strain of groundnut mentioned in last season's detailed report has been accepted as an all-round superior yielding type, and variety work with this crop has been discontinued. Bulks of groundnuts planted on succeeding dates throughout the season again demonstrated "Rosette" virus disease as a serious limiting factor. Experience of the crop shows that Rosette disease will preclude its general use in rotation with cotton in the Barberton area. Planted early, in November, a good crop may be obtained, but the planting of groundnuts would then clash with cotton planting, and further, late rains would in many seasons damage the crop while still on the land by causing the nuts to germinate *in situ*.

BARBERTON.

DAILY RAINFALL, SEASON 1933–34.

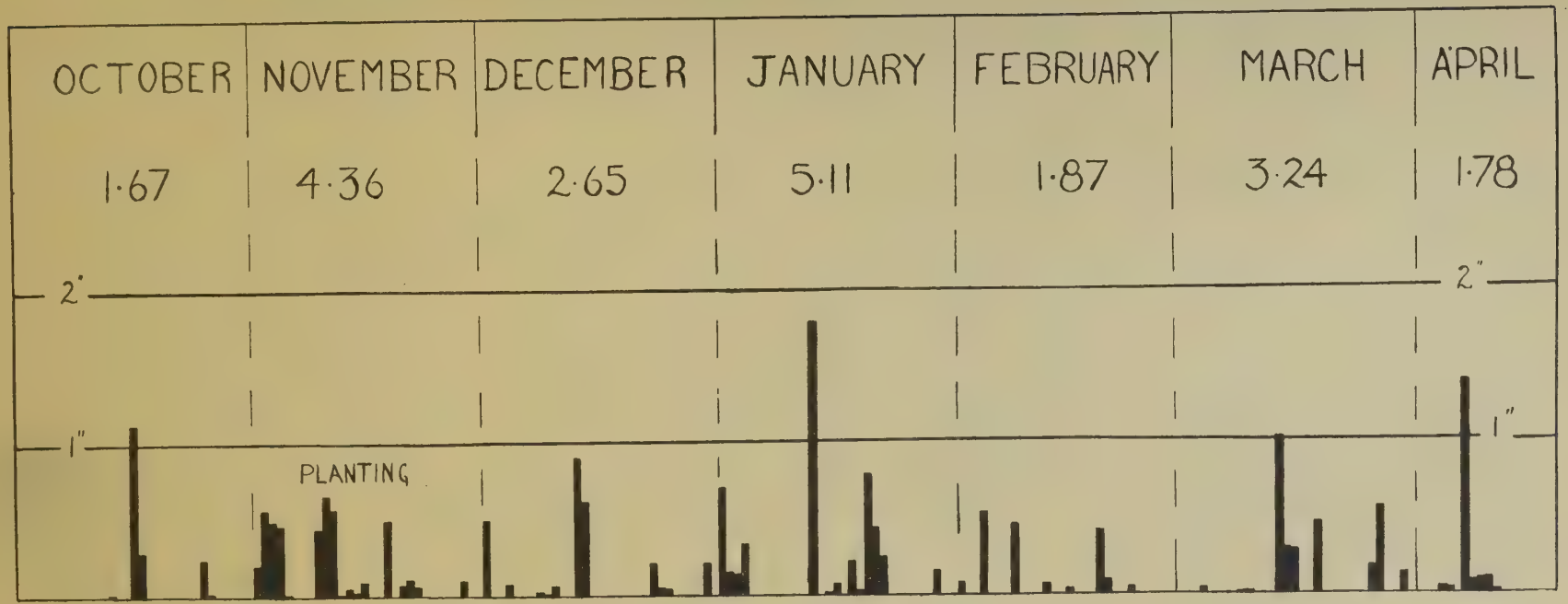
	July.	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*
1	...	...	0·26	...	0·20	0·49	0·76	0·07	...	...	...	...
2	...	...	0·03	...	0·56	...	0·15	...	...	...	...	...
3	...	...	...	...	0·48	...	0·14	...	...	...	...	...
4	...	...	...	...	0·46	0·07	0·32	0·53	0·04	0·05	...	...
5	...	...	...	...	0·01	...	...	...	...	0·04	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	1·39	...	...
8	...	...	...	...	...	0·02	...	0·46	...	0·08	...	...
9	0·02	...	...	...	0·44	0·01	...	...	0·11	0·10	...	...
10	0·45	...	...	...	0·66	0·06	...	...	0·14	0·10	...	...
11	...	...	...	...	0·56	...	...	...	...	0·02	...	...
12	...	...	...	...	0·01	...	...	0·07	...	...	...	...
13	...	...	...	0·01	0·05	0·90	1·78	...	...	...	...	...
14	...	...	...	...	0·02	0·61	...	...	1·02	...	...	...
15	...	...	...	...	0·08	...	0·01	0·03	0·30	...	...	...
16	...	...	...	1·12	...	...	0·07	...	0·28	...	...	...
17	...	...	...	0·28	...	...	...	...	...	...	...	0·15
18	...	...	...	...	0·49	...	0·22	...	...	...	0·02	0·37
19	...	...	...	...	...	...	0·03	0·42	0·47	...	0·03	...
20	...	...	...	...	0·07	...	0·79	0·10	...	...	...	...
21	...	...	...	...	0·11	...	0·44	...	...	...	...	...
22	...	...	...	...	0·06	...	0·24	...	...	...	...	...
23	...	...	...	...	...	0·21	...	0·19	...	...	...	...
24	...	...	...	...	...	0·04	...	...	...	...	...	...
25	...	...	...	0·24	...	0·03	...	...	...	...	0·16	...
26	...	...	...	0·02	...	...	...	...	0·18	...	...	...
27	...	...	...	...	...	...	...	...	0·57	...	...	...
28	...	...	...	...	0·10	...	...	...	...	...	...	...
29	...	...	...	...	...	...	0·16	...	...	...	0·02	...
30	...	...	...	...	...	0·21	...	...	0·13	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	0·47	...	0·29	1·67	4·36	2·65	5·11	1·87	3·24	1·78	0·23	0·52

Total rainfall for year, 22·19 inches.

BARBERTON

DAILY RAINFALL

SEASON 1933-34



COTTON EXPERIMENT STATION, MAGUT, NATAL.

PROGRESS REPORT FOR THE SEASON 1933-1934.

BY

P. A. BOWMAKER.

General Plot Layout.

In all experiments the randomized block system of comparison is used, with seven to ten repetitions, the larger number being used where the size of the Station fields permits. Planting is done by hand labour in variety tests, with four rows to a plot, the plots being approximately one-fiftieth of an acre in extent. In such trials as sunflower or cotton spacing experiments, where a marked difference in style of growth is usual, guard rows are planted.

The method of planting agronomic experiments by machine and thinning later to the required spacing has again been found satisfactory, both as giving a style of growth immediately after germination more similar to that seen under farming conditions, and as a saving of hand labour. It has the additional advantage that while often a field is too large for the experiment to be undertaken, the whole area may be planted at one time, thus obviating the " previous crop " effect shown in subsequent crops should completion of planting be delayed from any cause.

Cotton.

Variety Tests.

TABLE I.

Variety Test 1—1929 Selections compared with U.4 Bulk.

Difference required for significance (P=·01) 48 lbs. lint.

Strain.	*Yield, lbs. lint per acre.*
998	247
921	227
9243	214
920	204
U.4.4	202
052	199
9130	199
9264	195
9292	185
U.4. Bulk	175
9158	168
9355	165

TABLE II.

VARIETY TEST 2—EARLY STRAINS COMPARED WITH U.4 BULK.

Difference required for significance (P=·01) 37 lbs. lint.

Strain.	*Yield, lbs. lint per acre.*
998	313
050	280
951	271
046	270
938	261
052	255
955	255
045	252
U.4.4	251
U.4 Bulk	205

TABLE III.

VARIETY TEST 3—LATE STRAINS COMPARED WITH U.4 BULK.

Difference required for significance (P=·01) 55 lbs. lint.

Strain.	*Yield, lbs. lint per acre.*
921	219
920	218
0342	217
0270	215
0268	205
0267	204
0344	188
0343	179
U.4 Bulk	155

TABLE IV.

VARIETY TEST 4—921 RE-SELECTIONS COMPARED WITH U.4 BULK AND OTHER LATE STRAINS.

Difference required for significance (P=·01) 37·1 lbs. lint.

Parentage.	*Strain.*	*Yield, lbs. lint per acre.*
921	0102	291
921	099	290
921	0101	277
9355	0239	270
—	921	268
921	097	267
921	096	264
9355	0245	258
—	920	247
9355	0240	242
—	U.4. Bulk	235
9351	0231	231

TABLE V.

VARIETY TEST 5—MISCELLANEOUS STRAINS COMPARED WITH U.4 BULK.

Differences not significant.

Strain.	*Yield, lbs. lint per acre.*
0363	218
9243	209
0287	208
0289	208
920	198
9130	198
0221	196
0115	191
U.4 Bulk	191
9292	168

The tests were planted on November 13th and 14th. A few days after the emergence of the cotyledons above ground, very heavy rains damaged trials 2 and 5. Refilling was carried out satisfactorily early in December.

The heavy rainfall early in the season gave a woody style of growth particularly in the late strains. Trials 1, 3 and 4 which had made heavy growth proved attractive to the American Bollworm in February, and a large proportion of the early crop was lost.

Crosses of U.4 made in Trinidad with other Varieties.—Only very general observations have been possible as yet on these new strains, which were planted on the Station for the first time this season. As planting was delayed by rains, bearing was late, and in most cases only an indifferent stand was obtained from the small quantity of seed available.

Beyond a fair evidence of jassid resistance, as shown by certain strains proving quite non-resistant, little can be said of the families as yet. Of the fifty strains belonging to five families a number will in all probability be discarded after a further season of observation, owing to susceptibility to jassid. Bulk seed was taken from all strains.

Cotton Seed Multiplication.—All strains which were included in the variety trials were multiplied satisfactorily for seed purposes on half-acre blocks planted by machine at a thin rate of seeding. 920, 921 and 955 were used in agronomic trials on the Station, resulting in larger seed multiplication of these strains for distribution to growers, and facilities during the coming season for observations on them when grown on a larger scale over a wider area.

The seed from variety tests was bulked, and has been issued as an improved U.4 bulk to growers in the neighbourhood. It is felt that owing to the poor seasons which have been experienced for the last three years, insufficient is known locally about the merits of the different strains to warrant the issue of a more or less pure strain of a particular type for general planting. A mixture of strains is likely to prove safer.

Cotton under Irrigation.—Small areas of the strains 951 and 955 were planted by farmers under irrigation and gave fair returns, with the indication that these fine wooded strains are quite suited to the requirements of irrigation. 955 also proved satisfactory for irrigation purposes in the Nkwaleni valley.

A canal from the Pongola River has recently been completed in the district, and 12,000 acres of irrigable land are shortly to be brought into cultivation.

Cotton Cultivation Trials.

TABLE VI.

SUPERPHOSPHATE TRIAL.

Treatment.	*Yield, lbs. seed cotton per acre.*
No treatment	783
200 lbs. super. per acre	756
400 lbs. super. per acre	702
600 lbs. super. per acre	766

No significant difference.

The comparison was made on the basis of seven repetitions in randomized blocks. Superphosphate was ploughed in in September, and planting completed on November 13th.

The yield figures shown in Table VI show no difference in yield due to treatment, and there was no apparent difference in behaviour at any stage of growth.

TABLE VII.

CROP ROTATION TRIAL.

Cropping, 1932–33.	*Yield, lbs. seed cotton per acre*, 1933–34.
Sunn Hemp Seed	866
Groundnuts	860
Tepary	844
Maize	823
Sunflower	806
Soya Bean	797

No significant difference.

The results shown in Table VII are based on eight repetitions of each treatment arranged in randomized blocks. The strain 955 was used for the experiment, planting being completed on November 13th. No differences in behaviour during growth, due to previous cropping, were noted.

Preparation of a field for a repetition of the experiment in season 1934–35 was satisfactorily concluded.

TABLE VIII.

SPACING TRIAL.

Spacing.	*Yield, lbs. seed cotton per acre.*	
3′ 6″ × 2′ 6″	756	
3′ 6″ × 1′ 6″	750	P=·0014
3′ 6″ × 2′ 0″	749	
3′ 6″ × 1′ 0″	610	

Significant decrease in close spacing.

The spacing experiment was planted on November 28th, distinctly on the late side. U.4.4 was used for the experiment, as representing

a medium style of habit among the strains from U.4 which are under observation at present.

A heavy loss of crop occurred during the bollworm infestation of February–March, and, as has occurred in other seasons, the close spacing was not able to respond to later weather conditions.

The heavy losses caused by American bollworm in March have now been noted in the district for four consecutive seasons, and this, combined with the very uncertain rainfall later in the year, renders a spacing between plants of closer than 18 inches undesirable until more is known about bollworm control.

Rotation Crops.

Maize.

Selection Work.

Ninety-five single cobs, from selections made as described in the previous Report, were planted in square plots on December 29th, and from these a further selection has been taken.

Weather conditions subsequent to planting were not suitable for selection for drought resistance. The character of production of female flower in good time to receive pollen was again used as a basis of selection, combined with other desirable points.

A large number of single plants has been selected for further in-breeding in the coming season.

Commercial Varieties.

TABLE IX.

Planting Dates and Yields of Commercial Varieties of Maize.

Variety.	*Planting Date.*	*Yield, lbs. per acre.*
Anveld	19.10.33	1,852
Anveld	20.12.33	1,368
American White Flint	7.12.33	2,176
American White Flint	18.12.33	1,428
American White Flint (Selection)	20.12.33	1,850
Peruvian Red	29.12.33	760
60 Day Flint	7.2.34	178

Table IX is a record of the maize crops grown for native labour rations on the Station, and for rotation purposes. In addition to these comparatively large areas, small observation plots of six commercial varieties were planted when rainfall conditions permitted, which amounted to five dates of planting. As some indication of the comparative commercial value of these varieties, the results are given in Table X.

TABLE X.

OBSERVATION PLOT YIELDS OF SIX MAIZE VARIETIES ON DIFFERENT PLANTING DATES.

Planting Date	9.12		26.12		3.1		1.2		20.2	
Varieties.	*No. of cobs.*	*Wt. of cobs. (lbs.)*	*No. of cobs.*	*Wt. of cobs. (lbs.)*	*No. of cobs.*	*Wt. of cobs. (lbs.)*	*No. of cobs.*	*Wt. of cobs. (lbs.)*	*No. of cobs.*	*Wt. of cobs. (lbs.)*
American White Flint ...	73	34	71	31	70	31	57	23	57	21
Anveld	63	31	68	30	58	28	45	19	53	19
Hickory King	63	31	60	25	38	21	41	19	35	17
Salisbury White	48	28	29	16	19	13	22	13	12	7
Peruvian Red	103	25	95	25	86	22	71	16	58	13
60-Day White	5	3	26	16	14	5	35	8	22	6

The figures in Table X are from an equal number of plants in each case.

Sunflower.

A field was planted to black sunflower on December 19th, and from it a spacing experiment was thinned on January 10th. A standard width of 3 feet between rows was adopted, with a comparison of 2 feet, 2 feet 8 inches, 3 feet 4 inches and 4 feet between plants.

The usual rapid drying-out of the soil was noted in March, after which soil moisture conditions were never sufficient for the requirements of the plant in any spacing. The results of the experiment are given in Table XI.

TABLE XI.

SUNFLOWER SPACING TRIAL.

Spacing.	*Yield, lbs. per acre.*
3′ × 2′	834
3′ × 2′ 8″	810
3′ × 3′ 4″	786
3′ × 4′	727

S.E. of mean difference 26·4 lbs. per acre.

Tepary Beans.

A field was planted on February 8th, to tepary beans, to be used as a spacing experiment. Inter-row widths of 1 foot 9 inches, 2 feet 8 inches, 3 feet and 3 feet 6 inches were planted for comparison, with subsequent thinning to 3 inches, 6 inches, 9 inches, 12 inches and 18 inches within the rows.

Owing to insufficient rainfall after planting, yields were poor. In May, when the plots were practically ready for harvesting, a number were damaged by locusts, and yields from these had to be omitted. In consequence statistical examination is not possible, but yields from undamaged plots are given in Table XII, as the results are worthy of note.

TABLE XII.

TEPARY BEAN SPACING EXPERIMENT.

(*Yield in lbs. per acre.*)

Inter-row width	1′ 9″	2′ 8″	3′ 0″	3′ 6″
Spacing within rows.				
3″	865	915	826	832
6″	953	855	863	806
9″	836	707	745	715
12″	963	873	778	679
18″	767	683	661	533

Groundnuts.

TABLE XIII.

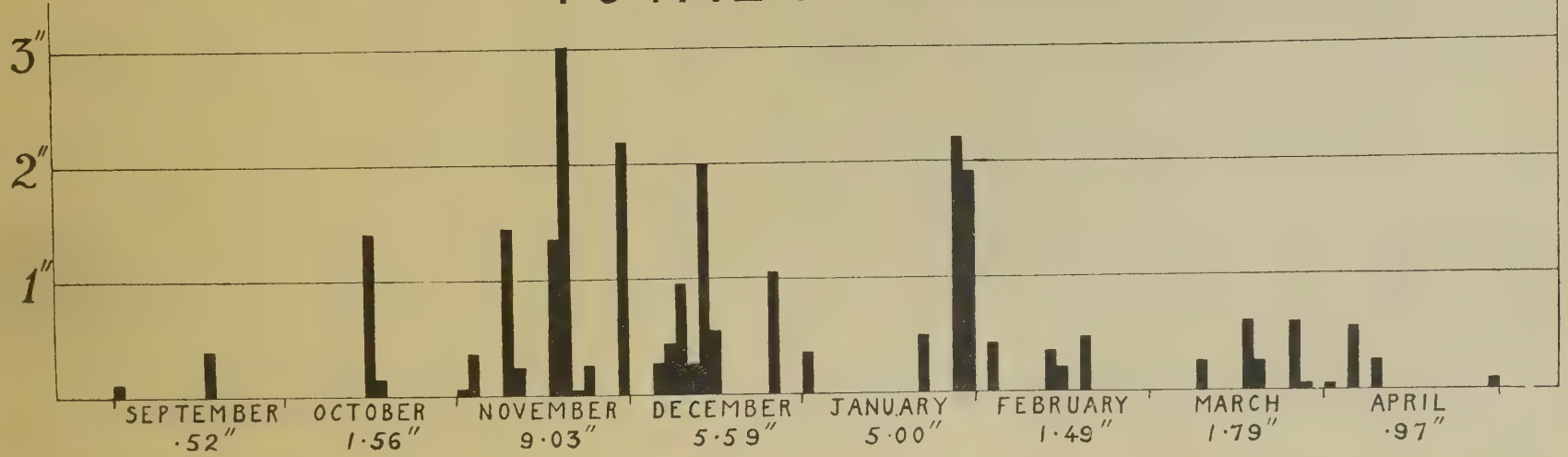
YIELDS IN GROUNDNUT VARIETY TEST.

Variety.	*Yield in lbs. per acre.*	
	Unshelled nuts.	*Haulm.*
Spanish 9	1,162	1,120
Barberton Strain	1,151	1,141
Natal	1,144	1,214
Japanese	791	1,147
Virginia Bunch	490	504

The groundnut variety test was planted on February 6th and was concluded satisfactorily. The yield figures are based on nine repetitions of each variety in randomized blocks.

In view of the limited rainfall subsequent to planting, the yields shown are considered particularly satisfactory.

MAGUT EXPERIMENT STATION,
SEASON 1933–1934.
RAINFALL IN TWO-DAY TOTALS.
TOTAL FOR SEASON 25·95″



SWAZILAND

COTTON EXPERIMENT STATIONS, BREMERSDORP AND INGWAVUMA.

PROGRESS REPORT FOR THE SEASON 1933-1934.

BY

J. V. LOCHRIE.

The rainfall on the Bremersdorp Station was high and well distributed and the season afforded an opportunity of testing the strains of the various crops under conditions of high rainfall, compared with the drier and shorter seasons of the past few years. The cotton experiments at Ingwavuma were damaged by hail and locusts and no reliable data were obtained. The figures and notes in the report refer to experiments on the Bremersdorp Station.

Cotton.—(1) *Variety Trials of U.4 Selections.*—The trials included the strains which had been most promising in past seasons, together with a number of the newer selections from the Barberton Station. Planting conditions were good and excellent stands were obtained. Bollworm was present throughout the season, but at no period were the losses particularly high. The yields and other particulars of the strains are given below.

TABLE I.

The yields are stated as percentages of the lint yield of U.4. Bulk.

Strain.	*Trial* 1. 6 *Replicates.*	*Trial* 2. 6 *Replicates.*	*Trial* 3. 3 *Replicates.*	*Ginning Percentage.*	*Weight* 100 *Seeds gms.*
076 Early	121·6	157	—	38·4	8·9
052 Early	115	136	—	36·9	8·3
921 Late	114	—	109	36·0	8·9
4/4 Early	112	128	—	37·9	8·5
9355R Medium	112	—	—	37·4	7·85
9243 Medium	112	—	—	37·8	8·6
920 Late	110	—	113	35·8	8·5
9292 Late	110	—	—	36·3	8·9
9264R Late	103	—	—	34·9	8·2
9158R Early	101	—	—	35·0	8·9
9130R Medium	91	—	—	34·2	8·0
045 Early	—	132	—	37·6	8·0
951R Early	—	131	—	37·8	8·7
938 Early	—	122	—	38·0	7·2
955R Early	—	120	—	36·8	8·4
A.0101 Late	—	—	124	38·2	8·2
A.269 Late	—	—	119	37·4	8·42
A.097 Late	—	—	112	37·2	8·9
A.099 Late	—	—	111	37·8	8·5
A.096 Late	—	—	102	36·0	8·8
B.0268 Late	—	—	110	36·7	9·45
B.0270 Late	—	—	110	37·3	8·76
B.0267 Late	—	—	110	35·7	9·2
C.0343 Late	—	—	101	35·6	8·9
C.0342 Late	—	—	97	36·0	8·76
C.0344 Late	—	—	90	35·1	9·0
9247 Medium	—	—	100	37·6	8·6
Difference required P=·05 ...	12·4	19·6	—	—	—
Mean yield per acre, U.4 Bulk	338 lbs. lint	241 lbs. lint	404 lbs. lint	35·8	8·91

NOTE.—Strains marked A. are selections from 921.
" " B. " " " 920.
" " C. " " " 9264.

In practically every case the strains under test show increases in yield compared with U.4 bulk. Of the older strains, 921, 920, and 9243, which have been consistently good in past seasons, again yielded well.

A feature of the season has been the success of the early strains at Bremersdorp. In the preceding seasons the early and finer types have not shown to such advantage. It is considered that the conditions this year favoured the early strains, as they were less affected by the lower temperatures and high stainer infestation that marked the latter part of the season. These conditions reduced the yields from the final reaping of the later strains.

Spacing Experiment (*a*).—The results given were obtained from an experiment grown under excellent soil and moisture conditions. Bollworm losses were slight and the stands and growth were good.

TABLE II.

Spacing.	*Yield per acre. lbs. seed cotton.*	*Notes.*
3′ 6″ by 12″	1,520	Random block arrangement with 6 replicates.
3′ 6″ by 18″	1,475	
3′ 6″ by 24″	1,505	
3′ 6″ by 30″	1,269	

Differences required for significance—P= ·05, 120 lbs. per acre.
P= ·01, 167 lbs. per acre.

The wide spacing was very much lower in yield than the closer spacings in the trial, and this confirms the results of previous experiments.

Spacing Experiment (*b*).—This experiment was designed to test the value of a spacing which, by facilitating adequate after-cultivation by ox- or mule-drawn cultivators, would reduce the amount of hand labour required.

TABLE III.

Spacing.	*Yield per acre. lbs. seed cotton.*	*Note.*
3′ by 18″	760	Random block arrangement with 6 replicates.
3′ by 3′ (1 plant)	590	
3′ by 3′ (3 plants)	755	

Difference required for P= ·05, 148 lbs. per acre.

As in Experiment (*a*) the wide spacing gave a considerably reduced yield, but this loss of yield was obviated where the plant density was increased by leaving three plants at the wide spacing of 3 feet by 3 feet.

Manurial Experiment.—The present experiment was laid down on a section of the station where the soil is light and shallow ; a soil condition seen to a considerable extent in the area.

TABLE IV.

Manurial Treatment.	*Yield per acre. lbs. seed cotton.*	*Rate of application per acre.*
Phosphate and Potash	580	160 lbs. bone flour plus 150 lbs. muriate of potash.
Potash	518	150 lbs. muriate of potash.
Kraal manure and Phosphate ...	514	160 lbs. bone flour plus 4,000 lbs. kraal manure.
Kraal manure	502	4,000 lbs. kraal manure.
Phosphate	426	160 lbs. bone flour.
Unfertilized	418	—

Difference required for P= ·05, 91 lbs. per acre.

As was expected on the poor soil in this section, the yields were low. Both series receiving potash gave better plant growth and significantly higher yields than the unfertilized plots.

The results from applications of kraal manure were less conclusive, though the appearance of these plots throughout the season was good. The plots receiving phosphate alone were very similar in appearance to those which were unfertilized.

Selections.—A number of selections were grown, from crosses made by Dr. Harland at the Trinidad Research Station, and these provided a very promising range of material for selection, including types varying greatly in earliness, resistance to jassid, and plant habit. Some, though healthy and jassid free, did not begin flowering until late in the season and are probably too late for this area. A number of others succumbed to jassid—it was noted that, though several of these lots were practically defoliated by jassid, the attack was not sufficiently severe to affect the strains of U.4. A number of selections were made and these will be carried on next season, together with the most promising of the original lots.

Maize.—Variety Trials.—A large number of maize varieties had been grown in the observation block in the previous year, and the most promising of these were tested this season at both stations. The results are tabulated below.

TABLE V.

Variety.	*Bremersdorp. Yield per acre.*	*Shelling. %*	*Ingwavuma. Yield per acre.*
Hickory King	3,570 lbs.	85	525 lbs.
Anveld	3,030 lbs.	88	1,600 lbs.
American White Flint	2,280 lbs.	84	1,355 lbs.
Peruvian Yellow	2,090 lbs.	90	1,475 lbs.
Golden Beauty	2,760 lbs.	83	1,225 lbs.
Early Yellow Flint	2,440 lbs.	85	1,215 lbs.
Difference required for—P= ·01 ...	616 lbs.	... ...	180 lbs.
P= ·05 ...	454 lbs.	... ...	135 lbs.

Under the excellent conditions experienced at Bremersdorp, and at the spacing used (3 feet by 15 inches), the later maturing dent types gave the best results.

At Ingwavuma the late-maturing Hickory King flowered during a dry spell at the end of February and was very poorly fertilised. Under the drier and hotter conditions there the early flint types showed up well, and the results of this test and of those from observation plots in other areas indicate the suitability of early flint varieties such as American White Flint and Peruvian Yellow for the poorer soils and in areas of low rainfall.

Rotation Experiment: Bremersdorp.—A. 1933–1934. First crop of maize following the various treatments.

TABLE VI.

Treatment.	*Yield of grain, lbs. per acre.*	*Shelling %.*
Sunnhemp ploughed in	3,940	86·5
Maize—harvested	3,870	86
Bare fallow	3,770	85
Groundnuts—harvested	3,580	86

Difference required for P=·05, 804 lbs. per acre.

This season the differences in yield were insignificant. As in the previous year, the maize following fallow made poor growth in the early part of the season but finished well under the excellent rainfall conditions.

B. 1933–1934.—Second crop of maize following a range of treatments. In the Table below the yields from the first crop of maize following the treatments are included for comparison.

TABLE VII.

Treatment.	*2nd maize crop*, 1933–34.		*1st maize crop*, 1932–33.	
	Yield per acre. lbs. grain.	*Shelling. %*	*Yield per acre. lbs. grain.*	*Shelling. %*
Sunnhemp (ploughed in)	3,700	85	2,020	83
Buckwheat (ploughed in)	3,700	85·5	1,760	79
Fallow	3,360	85	1,560	79
Groundnuts	3,310	85	2,060	84
Beans	3,125	85	2,000	82·5
Maize...	2,480	84	1,920	82·5
Difference P=·05 ...	410	... ...	338	

The 1932–33 season was drier and shorter, and the maize following fallow never made up the leeway after its poor early growth. Buckwheat gave a similar effect and the crop following these treatments was low in yield and in shelling percentage. In the second maize crop (1933–34) the beneficial effects of both green manure crops is evident and the growth-retarding effect of the fallow and buckwheat was not apparent.

Groundnuts : Variety Trials.—The results from the season's trials are given below.

TABLE VIII.

Variety.	*Bremersdorp.*		*Ingwavuma.*	
	Yield per acre. lbs. kernels.	*Shelling. %*	*Seed weight. grms.*	*Yield unshelled. lbs. per acre.*
Bremersdorp 2	2,230	76·7	·25	—
Spanish	1,880	77·2	·22	1,690
Barberton	1,850	75·9	·25	1,740
Bremersdorp 3	1,820	75·4	·26	—
Bremersdorp 1	1,790	74·7	·26	1,600
Japanese	1,575	80·5	·21	1,420
Java	1,300	75·5	·21	1,360
Virginia Bunch	1,120	70·9	·24	1,050
Difference required—P=·05 ...	370	... ...	... ...	... 164
P=·01 ...	490	... ...	... ...	... 218

The comparative results in this season of good rainfall are strikingly similar to those recorded in the previous year. Virginia bunch, the variety in general cultivation, was again the lowest in yield and in shelling percentage, and sufficient evidence is now available for its safe replacement for general cultivation by some of the newer varieties.

The Bremersdorp strains 1, 2 and 3, were originally selected for high resistance to drought, and it is interesting to note that they have yielded well in a high rainfall year. The characteristics of the varieties tested were included in the previous year's report.

Time of Planting.—Observation plots were grown at different planting dates from late December to mid-February to afford evidence regarding yield and incidence of " Rosette " disease. At Bremersdorp the most successful planting period appears to be late December and early January ; earlier plantings mature too early in the season and are liable to loss by germination before harvesting, while later plantings give decreased yields and a tendency towards " Rosette."

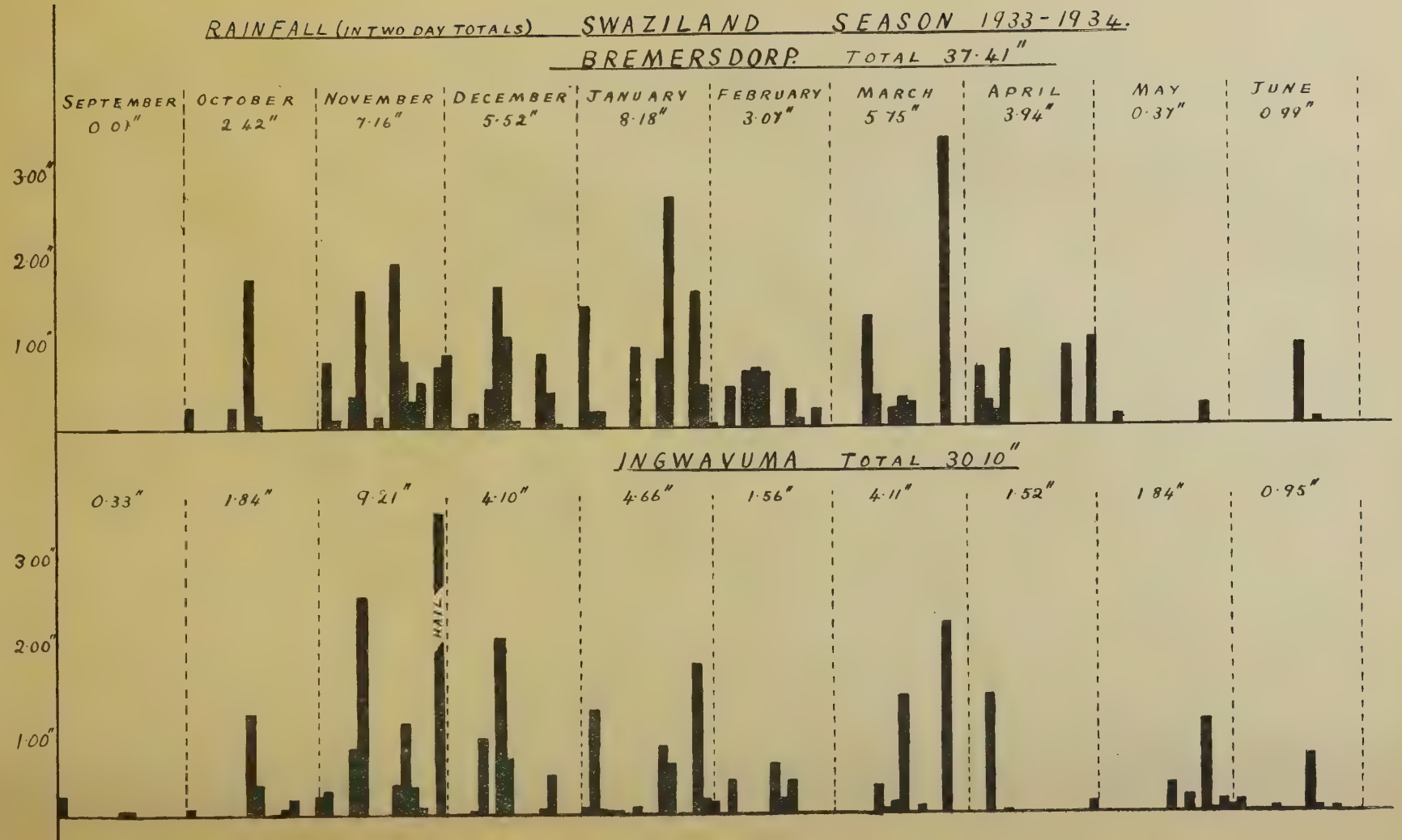
At Ingwavuma successful planting can be done until late January and here again " Rosette " is found only in late-planted crops.

BREMERSDORP.

DAILY RAINFALL, SEASON 1933-34.

Date	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*April*	*May*	*June*
1 ...	—	—	0·18	—	0·85	1·25	—	—	—	—	—
2 ...	—	—	0·08	0·42	—	0·15	—	—	—	—	—
3 ...	—	—	—	0·35	—	0·05	—	—	0·05	—	—
4 ...	—	—	—	—	—	0·13	0·45	—	0·63	—	—
5 ...	—	—	—	0·10	—	0·10	—	—	0·29	0·11	—
6 ...	—	—	—	—	—	0·09	—	—	—	—	—
7 ...	—	—	—	—	0·16	—	—	—	0·17	—	—
8 ...	—	—	—	—	—	—	0·63	—	—	—	—
9 ...	—	—	—	0·37	—	—	—	1·28	0·87	—	—
10 ...	—	—	—	1·61	0·40	—	0·66	0·35	—	—	—
11 ...	—	—	—	—	0·05	—	—	—	—	—	—
12 ...	—	—	0·25	—	—	—	0·62	—	—	—	—
13 ...	—	0·01	—	—	1·67	0·85	—	—	—	—	—
14 ...	—	—	—	—	1·03	0·06	—	—	—	—	—
15 ...	—	—	—	0·12	0·02	—	—	0·20	—	—	—
16 ...	—	—	1·75	0·01	0·07	—	—	0·31	—	—	—
17 ...	—	—	0·16	—	—	—	—	—	—	—	0·93
18 ...	—	—	—	1·92	—	—	—	—	—	—	—
19 ...	—	—	—	—	—	—	0·42	0·27	—	—	—
20 ...	0·08	—	—	0·12	—	0·78	0·09	—	—	—	—
21 ...	0·03	—	—	0·65	—	2·25	—	—	—	—	0·06
22 ...	—	—	—	0·10	0·55	0·42	—	—	—	—	—
23 ...	—	—	—	0·20	0·30	—	—	—	0·91	—	—
24 ...	—	—	—	0·51	0·40	—	0·20	—	—	—	—
25 ...	—	—	—	—	—	—	—	—	—	0·26	—
26 ...	—	—	—	—	0·02	—	—	3·27	—	—	—
27 ...	—	—	—	—	—	0·25	—	0·07	—	—	—
28 ...	—	—	—	0·15	—	1·31	—	—	—	—	—
29 ...	—	—	—	0·55	—	0·40	—	—	1·02	—	—
30 ...	—	—	—	—	—	0·07	—	—	—	—	—
31 ...	—	—	—	—	—	0·02	—	—	—	—	—
Total	0·11	0·01	2·42	7·18	5·52	8·18	3·07	5·75	3·94	0·37	0·99

Total for the year, 37·54 inches.


RAINFALL (IN TWO DAY TOTALS) SWAZILAND SEASON 1933-1934.
BREMERSDORP TOTAL 37·41"
SEPTEMBER 0·01"
OCTOBER 2·42"
NOVEMBER 7·16"
DECEMBER 5·52"
JANUARY 8·18"
FEBRUARY 3·07"
MARCH 5·75"
APRIL 3·94"
MAY 0·37"
JUNE 0·99"
3·00"
2·00"
1·00"
INGWAVUMA TOTAL 30·10"
0·33"
1·84"
9·21"
4·10"
4·66"
1·56"
4·11"
1·52"
1·84"
0·95"
HAIL
3·00"
2·00"
1·00"

SOUTHERN RHODESIA

COTTON-BREEDING STATION, GATOOMA, PROGRESS REPORT FOR THE SEASON 1933-34.

BY
J. E. PEAT.

Season.

From a climatic point of view the season has been good, the best since the Station started. The total rainfall was 25·77 inches (Fig. 1), and the distribution on the whole was very good. An inch or two more in the second half of February would have made the season an exceptionally good one. Planting rains came fairly early; cotton planting started on November 20th, and the whole crop, 132 acres, nearly twice as much as in any previous year, was in by December 3rd. With very favourable planting conditions, initial stands were good and the crop got an excellent start. In some of the other districts planting rains were not as early or as satisfactory as at Gatooma. The dry period in the second half of February and early March was more protracted in some of these other districts, and resulted in much heavier shedding loss there than on the Station.

Minimum temperatures in April, May and June (Fig. 2), were distinctly higher than in any previous year, and the winter was exceptionally mild. Insofar as it assisted the maturing of the later portion of the crop, this was a favourable factor. The lowest temperature recorded during these three months was 45° Fahrenheit in mid-June.

With very favourable weather conditions in the first part of the season, on the better land the crop grew out well. The rate of flowering was very satisfactory, higher than in any previous season (Fig. 3 (1)).

In a recording area of the strain U.4/64/7/10 (G.5, 11) at 6 inches intra-row spacing, one hundred flowers per day on scattered plants were tagged with dated tags. In Fig. 3 (2), is set out an analysis of the subsequent fate of these tagged flowers. The three classes of loss—(*a*) shed bolls showing bollworm punctures, almost entirely caused by American bollworm; (*b*) shed bolls, not bollworm punctured, the so-called "natural" shedding; and (*c*) a group comprising unsound bolls, mummified bolls, plus unaccounted loss, are added to the crop of sound bolls recovered to complete the record of the fate of the flowers tagged.

The crop, around 900 lbs. of seed cotton per acre, was made from the early (February) flowering. The amount of bollworm loss can be compared with the " natural " shedding loss occasioned by the dry spell in February and early March. This " natural " shedding loss was heavier on the poorer types of soil, as well as in some of the other districts where the droughty spell was longer and more severe than on the Station.

A similar graph for an area where records were taken in a slightly later crop, shows a heavier proportion of early shedding loss, American bollworm and " natural " loss, with about half the crop made in March and April. Although a very well grown crop, it yielded only around 500–600 lbs. per acre.

On the Station, maize yields, as a result of the droughty spell mentioned, were rather poor.

Insect Work.

American Bollworm.—In most of the recording of egglaying, and insect populations, technique similar to that used at Barberton, was employed and, in the initial stages, considerable assistance was received from the workers on similar problems at that Station.

On the Station the records of the total American bollworm larval population on cotton weresi milar to those of the last few years (Fig. 4).* These records each year have been taken from weekly counts on scattered marked plants in an area representative for the season. For the purpose of comparing this year's records with those of previous years, instars have been grouped together to give a total larval population per hundred plants throughout the season. It will be noticed that the period of attack varies according to the earliness or lateness of the season.

In Mazoe and Lomagundi, the American bollworm attack was much more serious in the past season than at Gatooma. Many growers in those districts, as a result of the low price of cotton around the time of planting, were treating cotton rather as a secondary crop ; partly as a result of this and partly because of more difficult planting conditions than at Gatooma, much of their cotton was planted relatively late, after much of the maize. Where American bollworm attack was severe, it was the late planted cotton which suffered most. As in other years, the main attack developed after the maize crops had passed the stage attractive to the egglaying moths—the " tasselling " stage.

Records were kept of American bollworm egglaying on all the farm crops grown on the Station (Fig. 5, and Table II). In general, the

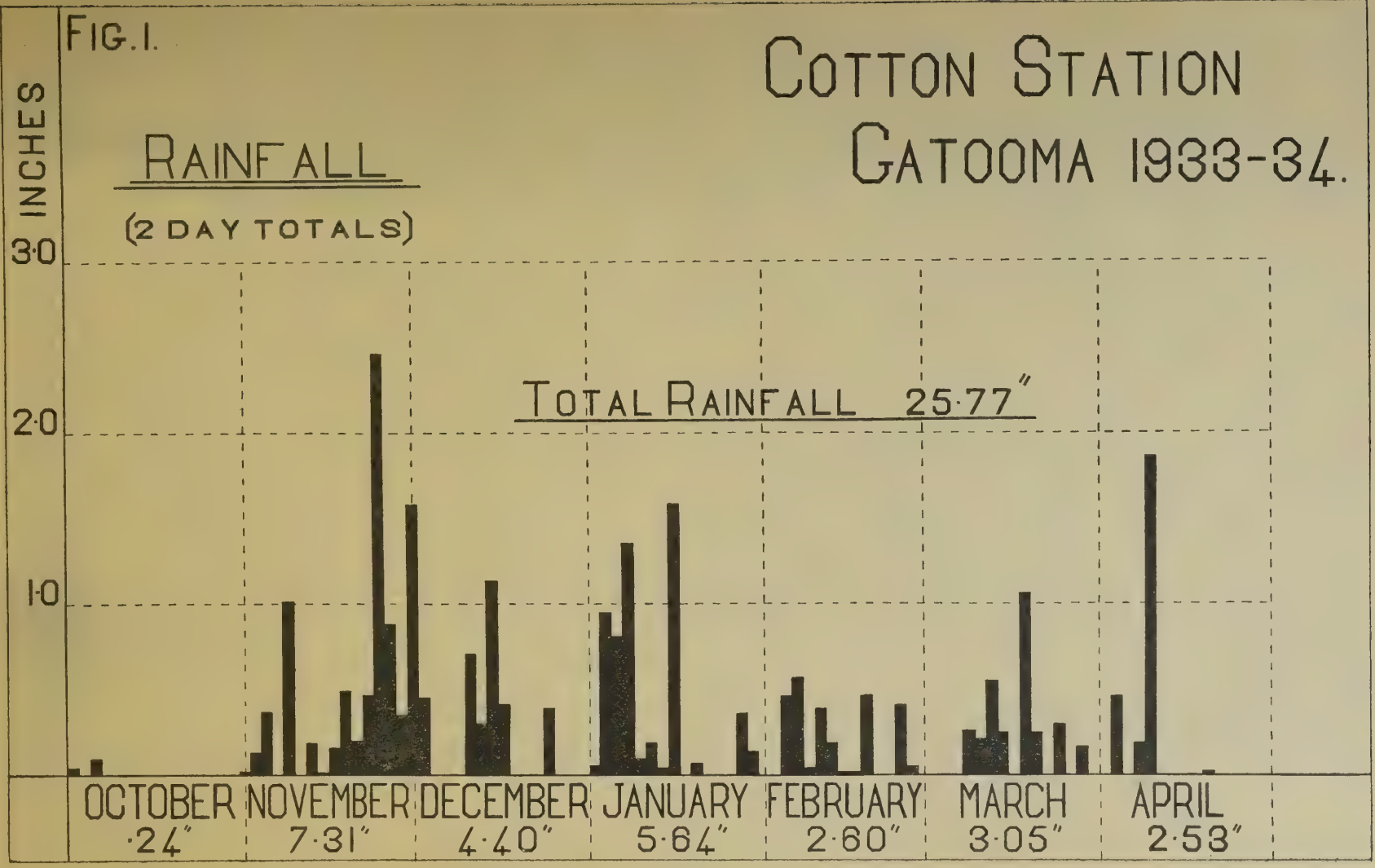
* For Figs. 4-10 see pp. 64-70.

FIG. 1.

COTTON STATION GATOOMA 1933-34.

RAINFALL

(2 DAY TOTALS)



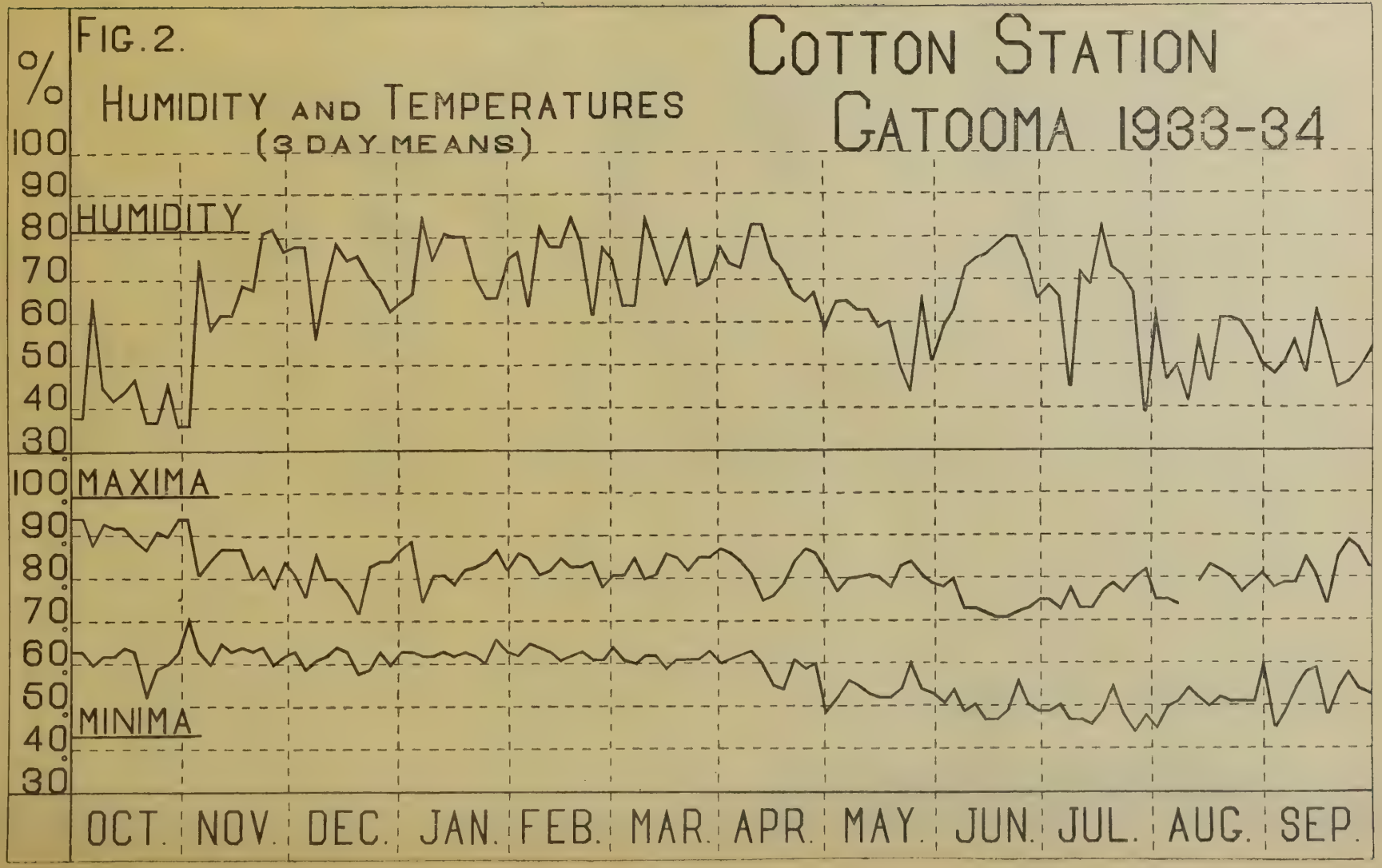


FIG. 2.
COTTON STATION
GATOOMA 1933-34
HUMIDITY AND TEMPERATURES
(3 DAY MEANS)
%
100
90
80
70
60
50
40
30
HUMIDITY
100°
90°
80°
70°
60°
50°
40°
30°
MAXIMA
MINIMA
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.

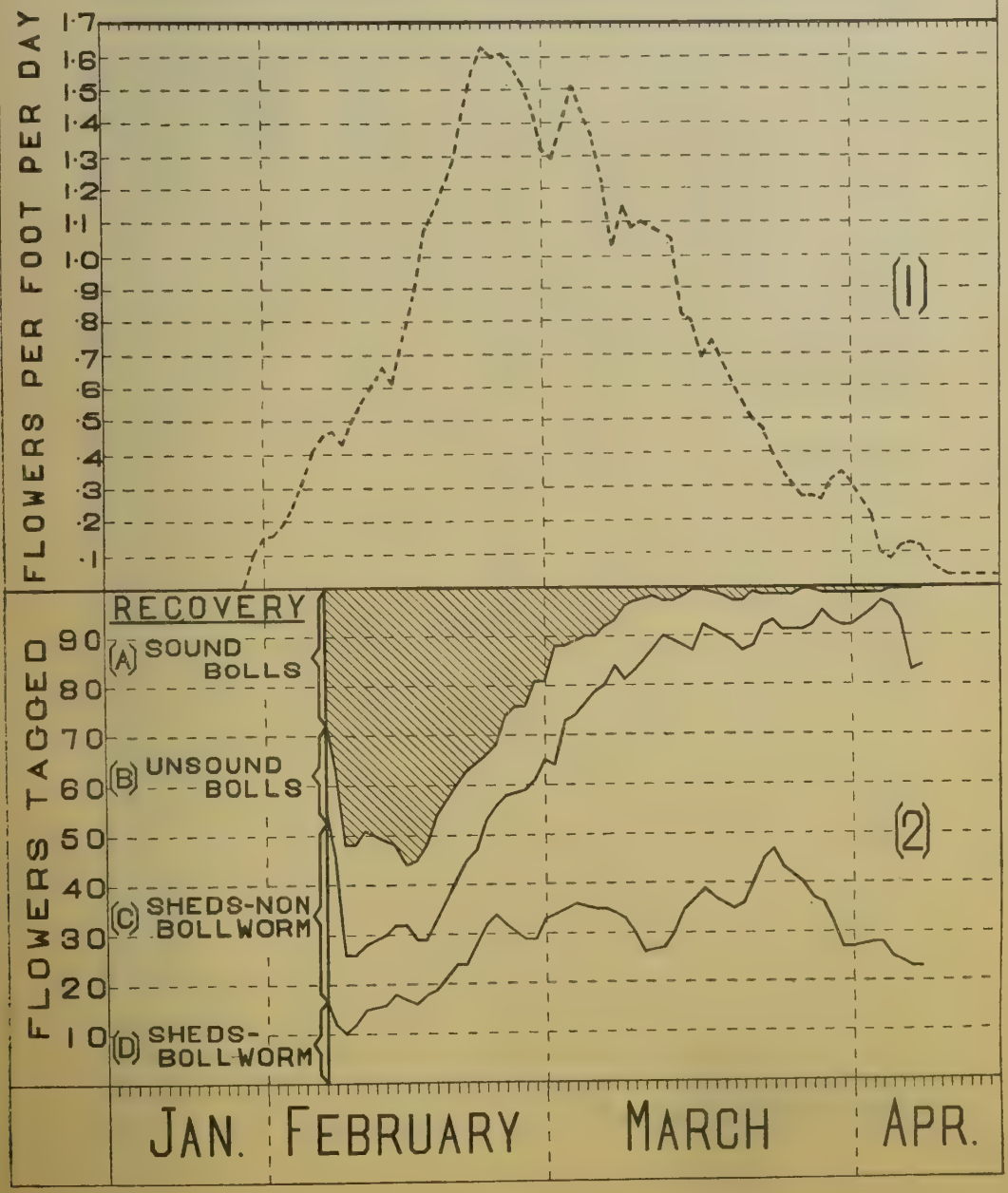
FIG. 3.

COTTON STATION GATOOMA-1934

COTTON CROP

(1) FLOWERING CURVE

(2) SUBSEQUENT FATE OF FLOWERS



attractive stage for each was the immediate pre-flowering and flowering stage. In Table II is set out for the year the number of days after planting at which the various crops started to flower, and for comparison, the period after planting during which these crops were attractive to American bollworm egglaying. Records were taken twice a week on scattered marked plants. Larval records were made once weekly on an equivalent number of adjacent plants.

TABLE II.

TIME OF FLOWERING AND PERIOD OF CROP ATTRACTION TO AMERICAN BOLLWORM EGGLAYING.

Crop.	*Land.*	*Date planted.*	*Number of days from planting to commencement of flowering.*	*Number of days from brairding to comencement of flowering.*	*Period after planting in which attractive to American bollworm egglaying.*
					Days.
Maize— (Hickory King variety) ...	—	15/11/33	60	—	63–84
Maize— (Hickory King variety) ...	B.A.	4–6/12/33	57	51	64–78
Maize— (Anveld variety)	H.C.	9/1/34	52	46	45–75
(White Cango variety) ...	H.C.	9/1/34	55	49	45–75
Maize—1st Trap— (Hickory King variety) ...	B.B.	22/12/33	56	50	56–73
,, ...	B.C.	22/12/33	55	49	52–73
,, ...	C.D.	23/12/33	56	50	52–73
Maize—2nd Trap— (Hickory King variety) ...	B.B.	8/1/34	56	50	45–75
,, ...	B.C.	5/1/34	59	52	48–78
,, ...	C.D.	8/1/34	56	50	45–80
Maize—3rd Trap— (Hickory King variety) ...	H.C.	20/1/34	56	52	46–76
,, ...	C.D.	19/1/34	56	51	43–73
Kaffir Corn— 1st planting	C.C.	14/12/33	68	63	68–89
2nd planting	C.C.	8–9/1/34	66	59	60–77
Cotton	B.B.	20–23/11/33	65	60	79–96–117
,, ...	B.C.	25–30/11/33	69	65	79–96–117
,, ...	C.A.	25–30/11/33	69	65	79–96–117
,, ...	C.D.	20–24/11/33	65	60	76–97–118
Sunnhemp	C.B.	4–5/12/33	56	50	60–85
,, ...	C.C.	15–16/12/33	56	51	60–85
,, ...	C.C.	10/1/34	51	46	60–85
Sunflowers	C.C.	14–15/12/33	72	67	72–102
Dolichos Beans	H.A.	10–17/2/34	52	47	61–82
,, ...	C.A.	17–22/2/34	53	44	53–74
Groundnuts	C.C.	16–19/12/34	30	24	30–40

It appears that in the maize-growing districts the American bollworm moths do not start heavy egglaying on cotton until the main maize crops in the vicinity have passed the attractive stage. Even then, a range of other crops, if at the right stage, appear to be as attractive as cotton, or even more attractive, to the American bollworm moths. Under Rhodesian conditions, with the range of crops grown, and

considerable acreages under plantings of maize, it is unlikely that cotton will be liable to the very serious " epidemic " American bollworm attacks experienced in some of the other cotton-growing areas.

Seeing that cotton is liable to heavy American bollworm attack after the commercial crops of maize have ceased to be attractive to the moths, the importance of earliness for the cotton crop can be seen. Early planting is important ; in fact, whatever the type of season, cotton should be planted as early as possible relative to the other crops grown, especially maize, so that as large a crop of bolls as possible may have set before the ordinary, commercially planted, maize ceases to be attractive to the egglaying moths. Other factors influence the earliness of the crop, such as earliness of thinning, and preventing the young crop from being checked by weed growth. Moderately close spacing makes for earliness. Medium soil in fair heart, if properly cultivated, allows for the development of an early crop. With heavier land wider spacing is generally necessary, and under these conditions early planting is of the greatest importance. Knowing the period after planting at which the other farm crops are normally attractive, it should be possible, by regulating planting dates, to have at least a portion of these at the attractive stage at the critical period for cotton, late February-early March, thus reducing for the moths the attraction of adjacent cotton crops.

As an extension of this idea, plantings of late maize were tried as traps to attract the egglaying moths. On the Station, plantings of maize were made at fortnightly intervals adjacent to the cotton lands so that these plantings gave a succession of crops attractive over the critical period for the making of the cotton crop. It will be necessary to work out in more detail the optimum proportions of trap area to cotton area. The results from the use of traps for the season did not show, with possibly one exception, anything like complete success. While fair egglaying was taking place on the maize traps—by no means " epidemic " egglaying—egglaying of a similar order was taking place on the nearby cotton (Fig. 5).

Records of egglaying for plantings of crops of different habit are not strictly comparable, but where the spacing is similar, a general idea can be formed of their relative attractiveness. On the Station, with such crops as sunnhemp, egglaying is recorded per square foot. On other crops it is difficult to get an accurate estimate of the amount of egglaying that is taking place. On kaffir corn plants, for example, counting eggs on the flower heads was difficult. In addition, owing to the glabrous nature of the plants, a considerable proportion of the eggs laid must have been washed off by rain. The amount of egglaying

per plant within a crop varies markedly with the habit and growth of the plant; in general, the larger and more vegetative the plant the greater the attraction. Again, the egglaying per plant is lighter where the acreage of crop at the attractive stage is large, *e.g.*, large acreages of commercially planted maize; and with the early plantings there is not such a close fit in the duration of egglaying to the flowering period. At the other extreme, egglaying on small areas of crops at the attractive stage, when practically nothing else is attractive, *e.g.*, a standover bean crop flowering before or after the main summer crops, may show very heavy " epidemic " egglaying. In the same way small acreages of very late maize were, by comparison with the earlier maize, heavily attacked, and with these, egglaying started before the plants had reached the " tasselling " stage.

Under native conditions, with small areas of cotton adjacent to, or interspersed with, a range of crops at different stages, the cotton probably gets a fair measure of cover from egglaying in the competing attractiveness of other crops, such as kaffir corn, maize and beans.

Fig. 6 gives records of egglaying on various cotton plantings on the Station at bulk spacing. Although these plantings were scattered over the farm on different types of soil, and although they varied somewhat in style of growth, the general type of egglaying curve is similar. The variations in the amount of egglaying can be explained by growth differences. The crop on land B–C, for example, was well grown, but for the Station relatively late; that on C–D, on a different type of soil, gave plants squat in habit and making the earliest crop on the Station.

Two records of egglaying on cotton made in the same field showed, at 6-inch spacing, an egglaying peak of 400 eggs per 100 plants per recording, compared with a peak of 1,000 eggs per 100 plants per recording on adjacent cotton at 2 feet spacing.

It is interesting to compare the rise and fall of the egglaying curves with the flowering curve given in Fig. 3 (1). The latter part of the flowering would be affected to a considerable extent by the loss of buds through American bollworm attack.

Comparing egg counts with first instar larval counts, there appears to have been a very heavy egg mortality (Fig. 7). From counts on cotton on the Station, apparently less than 10% of the eggs laid hatched out. Had even 50% of the eggs hatched out, the resulting attack would have been very serious. In Fig. 7 the low survival of American bollworm eggs is contrasted with the high survival of Sudan bollworm eggs, a high percentage of which hatched.

During the period of heavy egglaying, 30% up to 50% of the American eggs were parasitised by *Trichogramma lutea*. The percentage

parasitism of the main egglaying period is shown in Fig. 8. In working up these records, to avoid expressing sharp fluctuations in percentage parasitism, collections of less than 100 eggs were added together until parasitism for collections of a hundred or more could be recorded. Thus the record entered is the percentage parasitism during the period since the previous entry. Only occasional Sudan bollworm eggs were found to be parasitised.

In addition, an egg predator, *Orius* (*Triphleps*) sp., appeared to be very active in the cotton lands, and must have been taking a heavy toll of eggs. This season, by marking newly laid eggs each day and recording their subsequent fate, more exact records will be made of these controlling factors.

Sudan Bollworm.—In the last few years there has been, especially on the Station, serious Sudan bollworm damage in the later part of the season in March, April, and May amongst the developing bolls (Fig. 3). Coming on top of the American bollworm attack, and the loss from " natural " shedding, Sudan bollworm has taken a serious toll of the remaining maturing bolls. It is believed that the attacks have increased largely by a building up from year to year of an endemic Sudan moth population.

On the Station in the past season standover cotton traps, which were stripped at intervals, were used on a more thorough scale than in other years, with most promising results. The idea is to attract to these traps the moths emerging with the early rains from over-wintering pupae, and to keep as much as possible of their egglaying off the young annual crop. The main standover trap area was three acres, later reduced to one acre. Egg counts were made twice weekly on marked plants, and in addition larval records were made. On the Station comparatively heavy egglaying took place on the standover traps, while the attack on the annual crop was very considerably reduced from that of other years (Fig. 3).

Only occasional eggs were laid in September and October, but by the middle of November 150–200 Sudan bollworm eggs per 100 plants were being recorded per count on the traps. From then until records ceased at the end of March, egglaying of that order, up to 400–500 eggs per 100 plants per recording, was taking place. This is high in comparison with the egglaying on the annual crop. It was not realised at first that larvae could go through their life history and go down to pupate, feeding only on flower buds. At the start only bolls were stripped from the plants. Standover traps are being tried on a bigger scale this year. At intervals they will be grazed down with oxen and only the final stripping done by hand. Unless the traps are watched,

and buds and bolls stripped off at intervals of a fortnight to three weeks, there is a danger that, instead of reducing the Sudan bollworm population, a population will be bred up to attack the annual crop later in the season. For this reason it is probably not safe yet to advocate their general use by growers, but on the Station they are quite practicable.

Moths were found ovipositing freely on bushy perennial cotton, such as Moco and Tobago native. Perennials of this type are being used in further trapping experiments.

Records of egglaying last season and up to the time of writing show that few moths appear to be active until towards the end of October or early November. From results elsewhere it is thought that a big proportion of the moths from the over-wintering pupæ emerge fairly soon after the first rains. Cages of pupæ were put down at the end of the growing season with a view to studying this more fully for Gatooma conditions.

In the light of what is known about Sudan bollworm habits it can be seen that, apart from other considerations, ratooning would be highly inadvisable in a farming scheme. A Sudan bollworm population would be bred up on the ratoon crop, attacking the annual crop later in the season.

Stainers.—Throughout most of the country stainer damage was similar to that of other years, a factor lowering crop yield and quality, but not comparable in seriousness with American bollworm. Population counts were made, and the proportions of the different species present throughout the season were recorded to serve as indications of the proportions of the species present. There are certain variations between counts from land to land and from farm to farm. Records for a representative land on the Station are given in Fig. 9. These records were made twice weekly on random lengths of line in a block 9½ acres in extent in the middle portion of the land used. The first adults were observed in the crop on February 8th, and records started a week later.

Similar records were taken in Mazoe and Lomagundi. These show variations in the proportions of the different species present. In one, *D. superstitiosus* slightly predominates until April ; then *D. fasciatus* takes the lead. In a second, *D. fasciatus* slightly predominates over *D. intermedius* throughout the season, only a small *D. superstitiosus* population being present. In a third, *D. intermedius* predominates markedly, with very few *D. superstitiosus* present. In the fourth the records show much the same proportions as on the Station, *viz.*, all three present in the earlier part of the season, and *D. fasciatus* predominating markedly in the middle and later part of the season.

On the Station immature bolls, three to four weeks old, were collected each week over a random scatter of plants. These were classified for (*a*) degree of staining, and (*b*) number of stainer punctures. The results are given in Table III.

TABLE III.

STAINING RECORDS—3–4 WEEKS-OLD BOLLS.

Date.	*Degree of visible staining. Expressed as percentages.*					*Number of puncture proliferations per boll. Expressed as percentages.*				
	Nil.	*Very Light.*	*Light.*	*Medium.*	*Heavy.*	0.	1–5.	6–10.	11–15.	16–20.
26/2/34–28/2/34	62	25	2	7	4	42	44	6	5	3
5/3/34– 7/3/34	65	21	7	5	2	54	39	2	2	3
12/3/34–14/3/34	56	25	12	7	0	45	38	6	3	8
19/3/34–21/3/34	62	15	11	12	0	49	33	4	0	14
TIME OF FIRST BOLL OPENING.										
26/3/34–28/3/34	52	32	8	8	0	28	53	7	3	9
2/4/34– 4/4/34	25	35	23	9	8	16	36	16	10	22
9/4/34–11/4/34	31	28	18	10	15	16	26	12	9	37
16/4/34–18/4/34	13	18	26	14	29	9	8	14	9	60
23/4/34–25/4/34	11	11	31	23	24	5	18	9	6	62
30/4/34– 2/5/34	9	19	24	21	27	3	14	10	3	70
7/5/34– 9/5/34	7	14	23	26	30	7	3	1	7	82

In Fig. 10 (1) a curve of the number of bolls showing more than 10 punctures per boll, an arbitrary grouping, is contrasted with the curve of the number of grade 2 bolls, *i.e.*, bolls showing at least heavy or medium staining. The association between amount of puncturing, and extent of staining, is brought out. As the season advanced, the amount of puncturing and degree of staining increased with increase of stainer population, as would be expected.

Fig. 10 (2) illustrates in the same way the increased stainer damage in the later part of the mature crop. Mature bolls just opened, were collected once a week from units scattered over the 9½ acre record area. The loculi were classified for degree of staining. For the purpose of graphing, loculi are grouped into three degrees of staining. Fig. 10 illustrates the importance of having the crop early, and how necessary it is, from the point of view of stainer damage, to try to safeguard from loss, such as that caused by American bollworm, the early portion of the flowering to form the main part of the crop.

Seed cotton traps were put down as in other years. For about the first fortnight to three weeks after they had been put down the traps did good work : the numbers per acre caught on traps seemed to be very satisfactory compared with the population counts per acre. After the end of February the population numbers increased, but the numbers caught on traps decreased markedly. There are a number of possible reasons for this. A further trial of traps will be made this coming season.

A start has been made in recording wild host plant areas (*Sterculia* spp., *Thespesia* and Baobab), the time of fruiting of these hosts, and notes on the occurrence of stainer species on them.

In a " low veld " area, such as the Sabi Valley, the general fruiting period for *Sterculia* spp. is December, January, February, and for Baobabs, March and April. In " middle veld " areas such as Gatooma, Mazoe, and Lomagundi, the flowering and fruiting periods for these host plants are later ; in general, *Thespesia* and *Sterculia* are fruiting there around March, April, and May. Even within a district the time of fruiting varies to a certain extent with the location of the tree or group of trees. Old fruits may hang on through the year, especially on *Thespesia*, and provide food for stainer adults and nymphs. *D. fasciatus* and *D. intermedius* have been observed on old fruits in February and March.

Around Gatooma the host plant population appears not to be large and to consist of a few small areas of Baobab, and a certain amount of *Thespesia*. In Mazoe and Lomagundi, *Sterculia* spp. are fairly plentiful. *D. fasciatus* and *D. intermedius* have been recorded both on *Sterculia* and *Thespesia*.

Only in one area of the country, in the Sabi valley, has a crippling stainer attack been recorded on an otherwise excellent crop. It is a low veld area in the South-eastern corner of the country, with big possibilities both for European and for native cotton-growing. The veld is rich in natural host plants. Under irrigation, by trying a range of different planting dates, growers are attempting to evade, at least partially, serious stainer damage. Detailed observations are being attempted on the species populations in the successive crops. Records are being kept of the fruiting of natural host plants in the area, as well as of the species present on them.

Jassid.—As shown by the damage to the old Improved Bancroft and Durango, and to the non-resistant lots in Harland's crosses, it has been a season of quite serious jassid attack. Nymphal counts were made to contrast with those made in other years. Some of the U.4 lots suffered somewhat and one or two lots have been discarded for insufficient resistance. The important lot, U.4/64/7/10 (G.5, 11), though fair, has not quite the degree of resistance desired. Though most of the blocks of it were quite satisfactory, in occasional patches it suffered to some extent. It has not the jassid resistance of U.4/64/V (G.5, 21), but most of the re-selections from it seem better in this respect. The /34 lots continued to show excellent resistance, almost comparable with that of Cambodia, but unfortunately they are weak in other directions.

Aphis.—On the Station aphis was less troublesome than in most years. It was at its worst in the droughty spell in the second half of February and early in March, but disappeared after the satisfactory March rains. It was definitely noticeable that the more vigorous, more leafy, jassid-resistant /34 and /78 lots, suffered much more heavily from aphis and from American bollworm than the /64 lots.

Locusts.—Locusts were present in the country in large numbers throughout the season, and did a certain amount of damage to cotton as to other crops. On the Station very little actual damage was done, but a great deal of time was taken up in fighting hoppers threatening the cotton. Actually more than 20,000 gallons of locust poison were applied.

Breeding Work.

Strains.—From a breeding point of view the season has been an outstanding one. The total acreage in cotton, 132 acres, owing to a considerable increase in the acreage of strains under multiplication, was nearly twice as large as in any previous year. Differences between strains were clearly marked. Excellent yields were obtained in the multiplication of the improved strains and in the better single plant lots, and a considerable amount of valuable seed has been issued to growers for further multiplication and trial.

The old Improved Bancroft went down badly to jassid and suffered from American bollworm. In the end it finished up with only an odd boll here and there worth picking. The original mixed bulk U.4 was yielding about 500 lbs. seed cotton per acre, while the better U.4/64 lots, under similar conditions, were yielding around twice as much.

In mixed bulk U.4 a fair percentage of unsatisfactory non-productive types showed up, and in the observation plots mixed bulk U.4 could always be picked out by the relatively small crop carried, and the comparatively large proportion of lank, rather unproductive, plants.

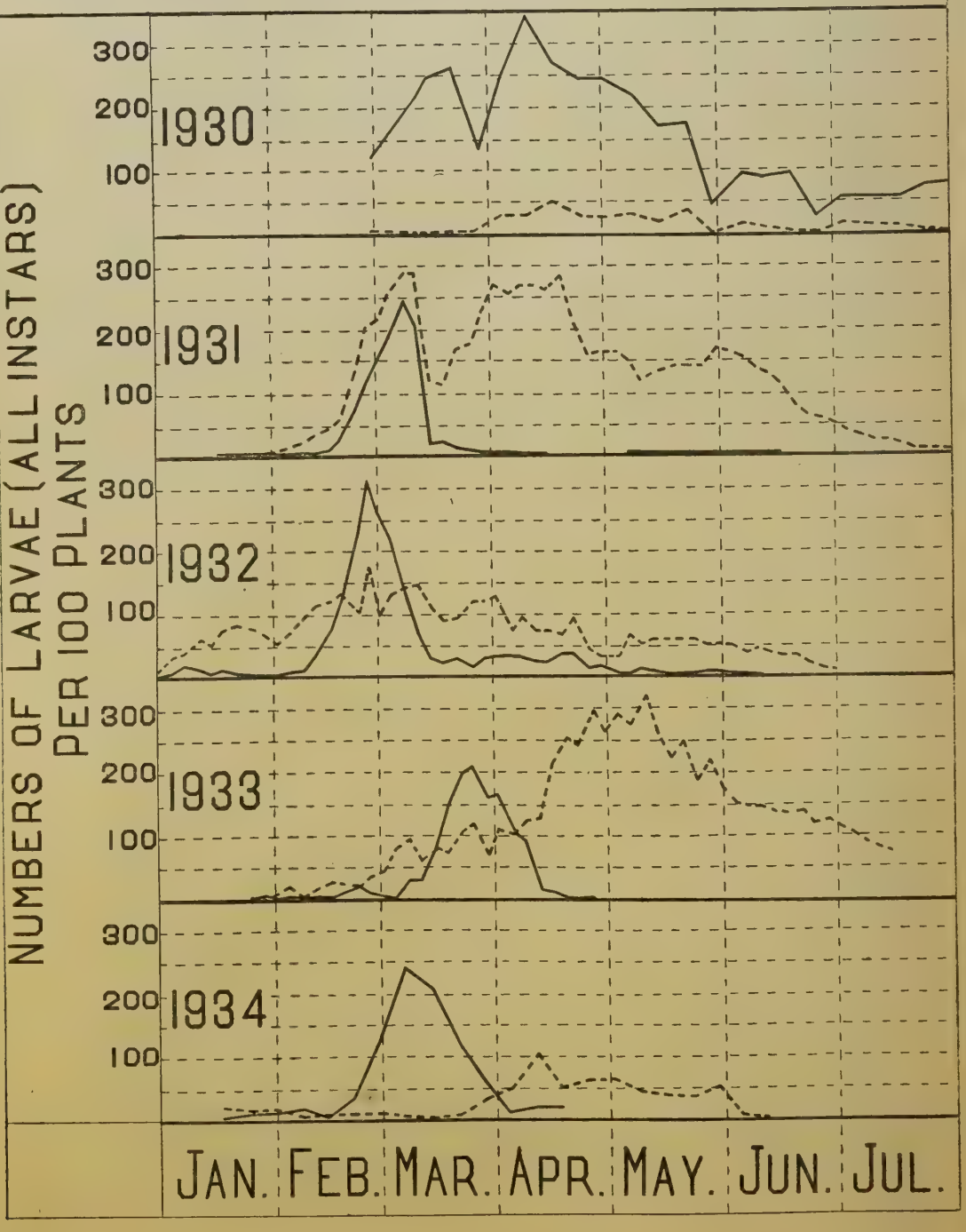
More markedly than in any previous year, both on the Station, and in the other districts, U.4/64 showed up as the outstanding parent stock, and the better strains are more suited to the conditions than anything else so far grown. The parent stock is a tough, early maturing, fairly open, medium-wooded strain. It is, however, splitting, and a proportion of less desirable types is showing up. The two substrains, U.4/64/7/10 (G.5, 11) and U.4/64/V (G.5, 21), which were in bulk in 1931–32, and were issued to growers for multiplication and observation in 1932–33, both gave good results. Under multiplication on the Station, with a thin stand as a result of a light seed rate, they were yeilding at the rate of 800–1,000 lbs. of seed cotton per acre.

FIG. 4.

COTTON STATION GATOOMA-1934

SEASONAL COMPARISON OF BOLLWORM POPULATIONS

KEY
AMERICAN B.W. ——
SUDAN B.W. - - - -



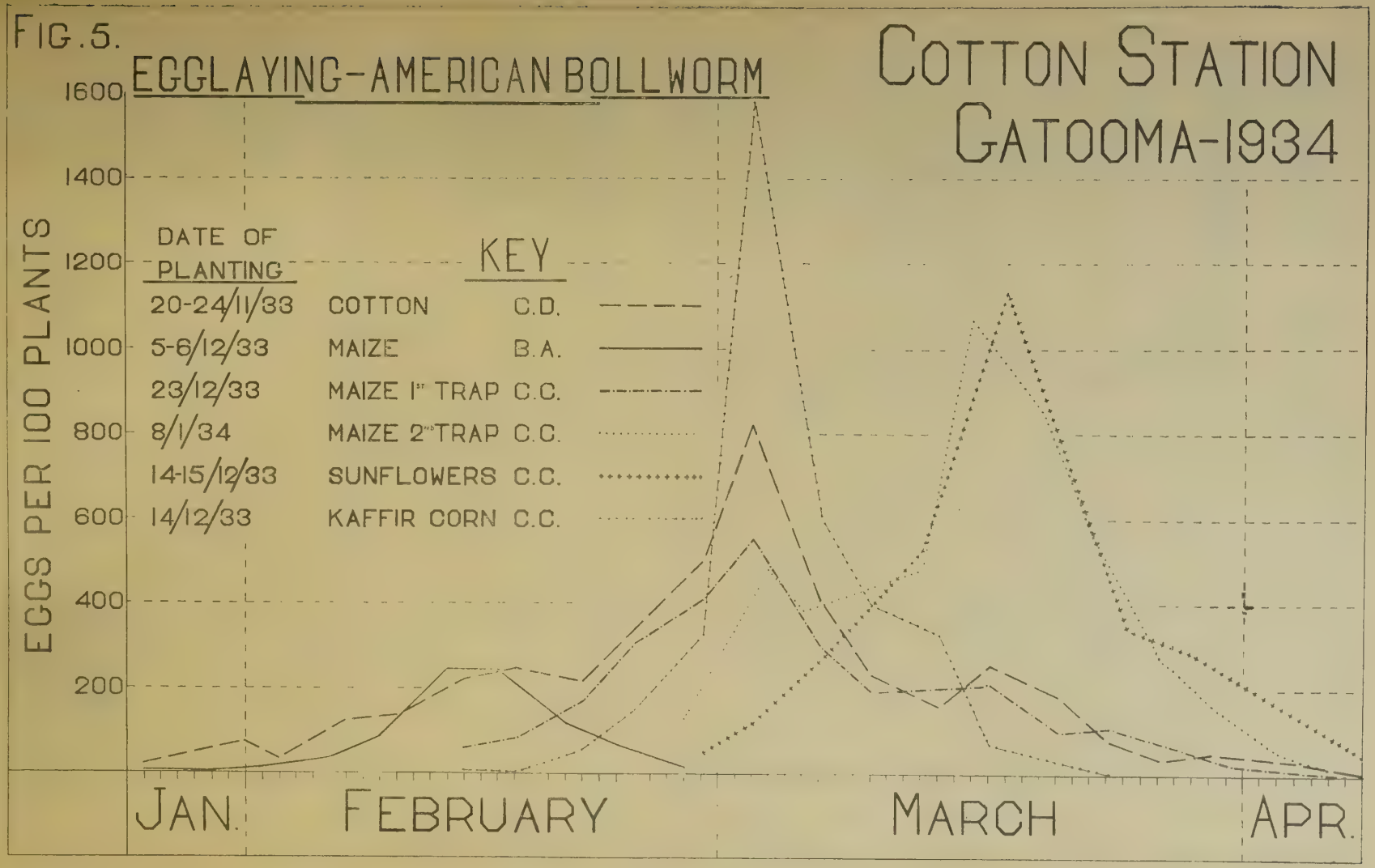


FIG.5.
EGGLAYING-AMERICAN BOLLWORM
COTTON STATION
GATOOMA-1934
EGGS PER 100 PLANTS
1600
1400
1200
1000
800
600
400
200
DATE OF PLANTING
KEY
20-24/11/33 COTTON C.D.
5-6/12/33 MAIZE B.A.
23/12/33 MAIZE 1st TRAP C.C.
8/1/34 MAIZE 2nd TRAP C.C.
14-15/12/33 SUNFLOWERS C.C.
14/12/33 KAFFIR CORN C.C.
JAN.
FEBRUARY
MARCH
APR.

FIG. 6.

COTTON STATION GATOOMA-1934

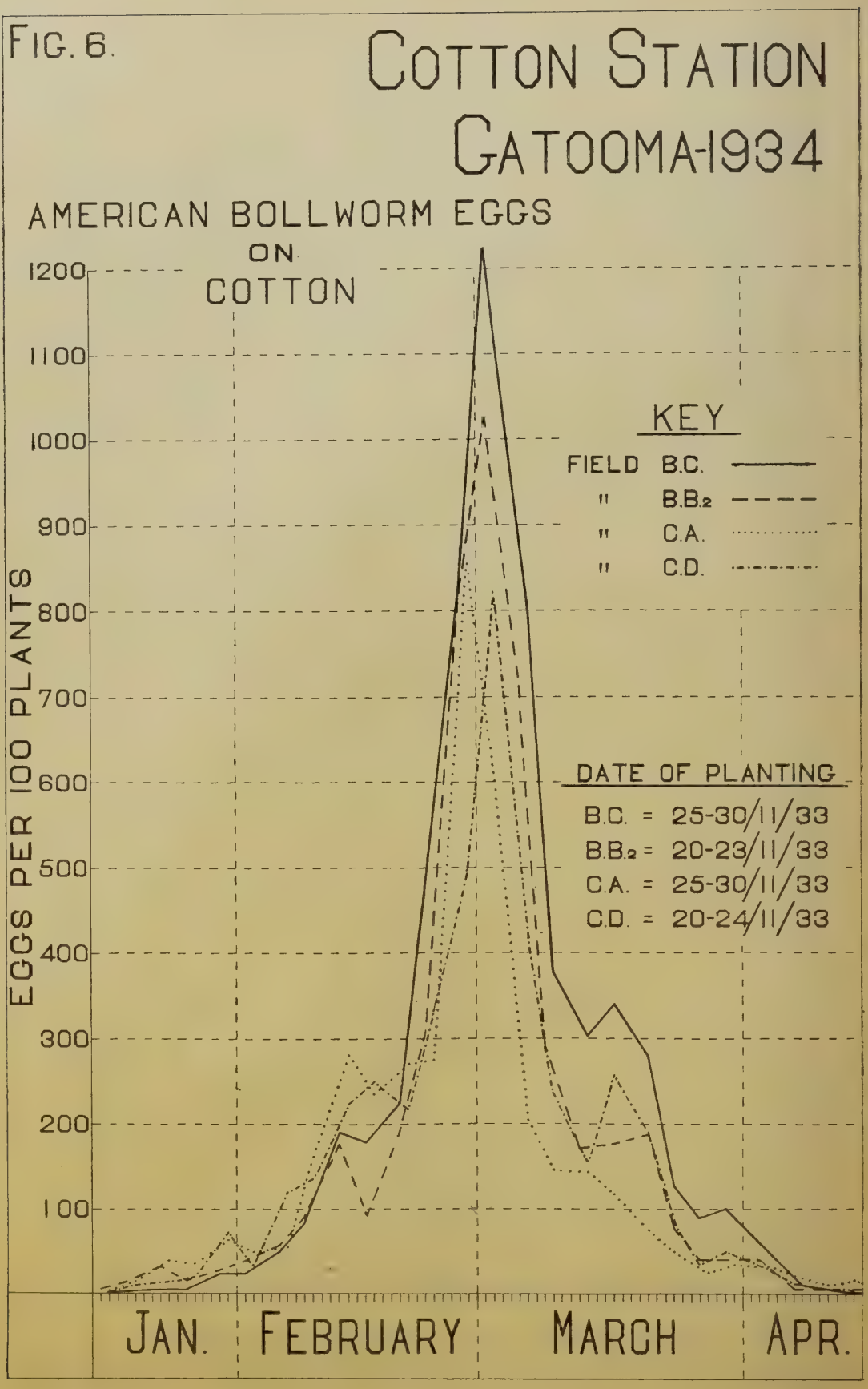
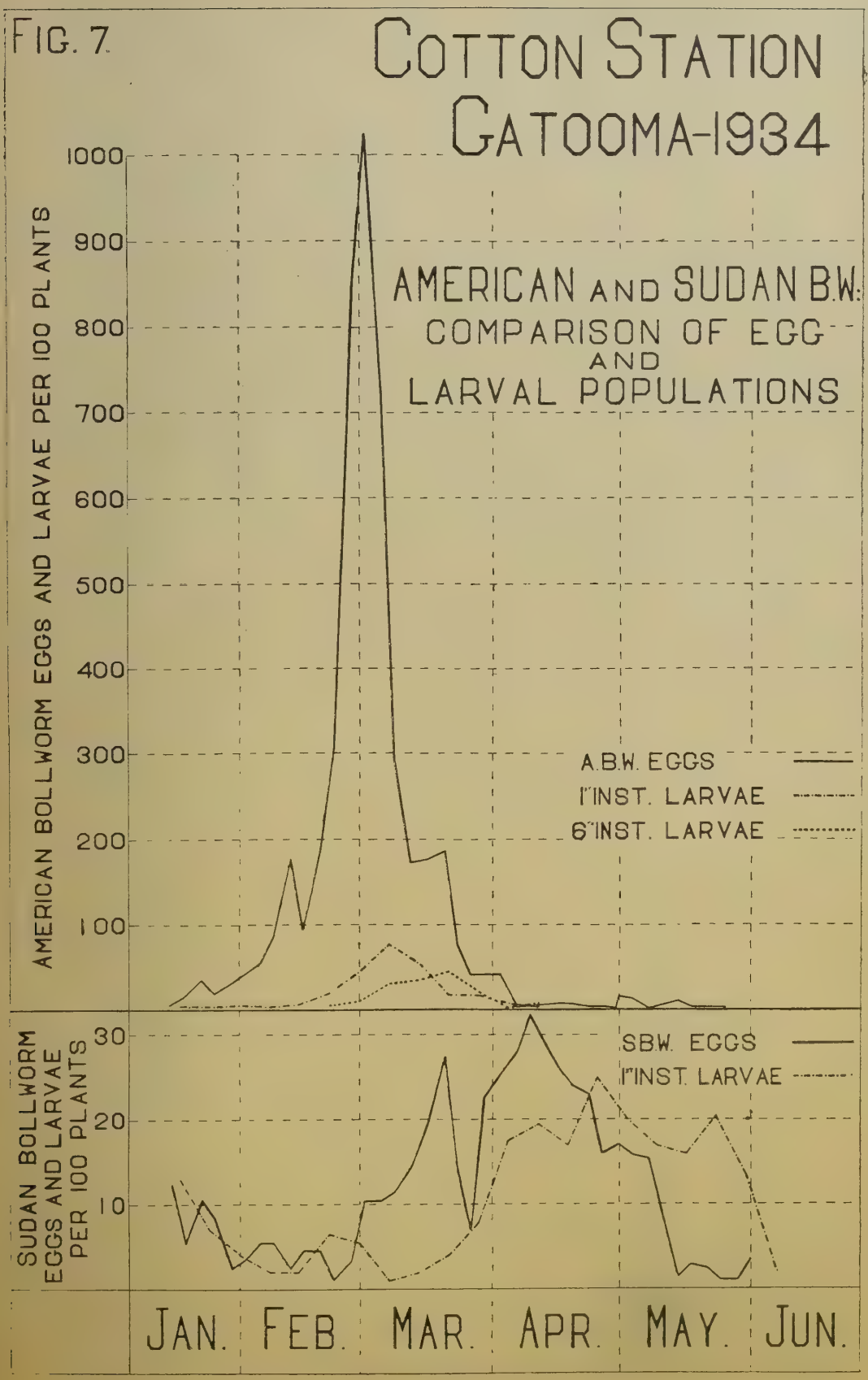


FIG. 7.


COTTON STATION
GATOOMA-1934
AMERICAN AND SUDAN B.W.
COMPARISON OF EGG
AND
LARVAL POPULATIONS
AMERICAN BOLLWORM EGGS AND LARVAE PER 100 PLANTS
1000
900
800
700
600
500
400
300
200
100
A.B.W. EGGS
1ST INST. LARVAE
6TH INST. LARVAE
SUDAN BOLLWORM EGGS AND LARVAE PER 100 PLANTS
30
20
10
S.B.W. EGGS
1ST INST. LARVAE
JAN.
FEB.
MAR.
APR.
MAY.
JUN.

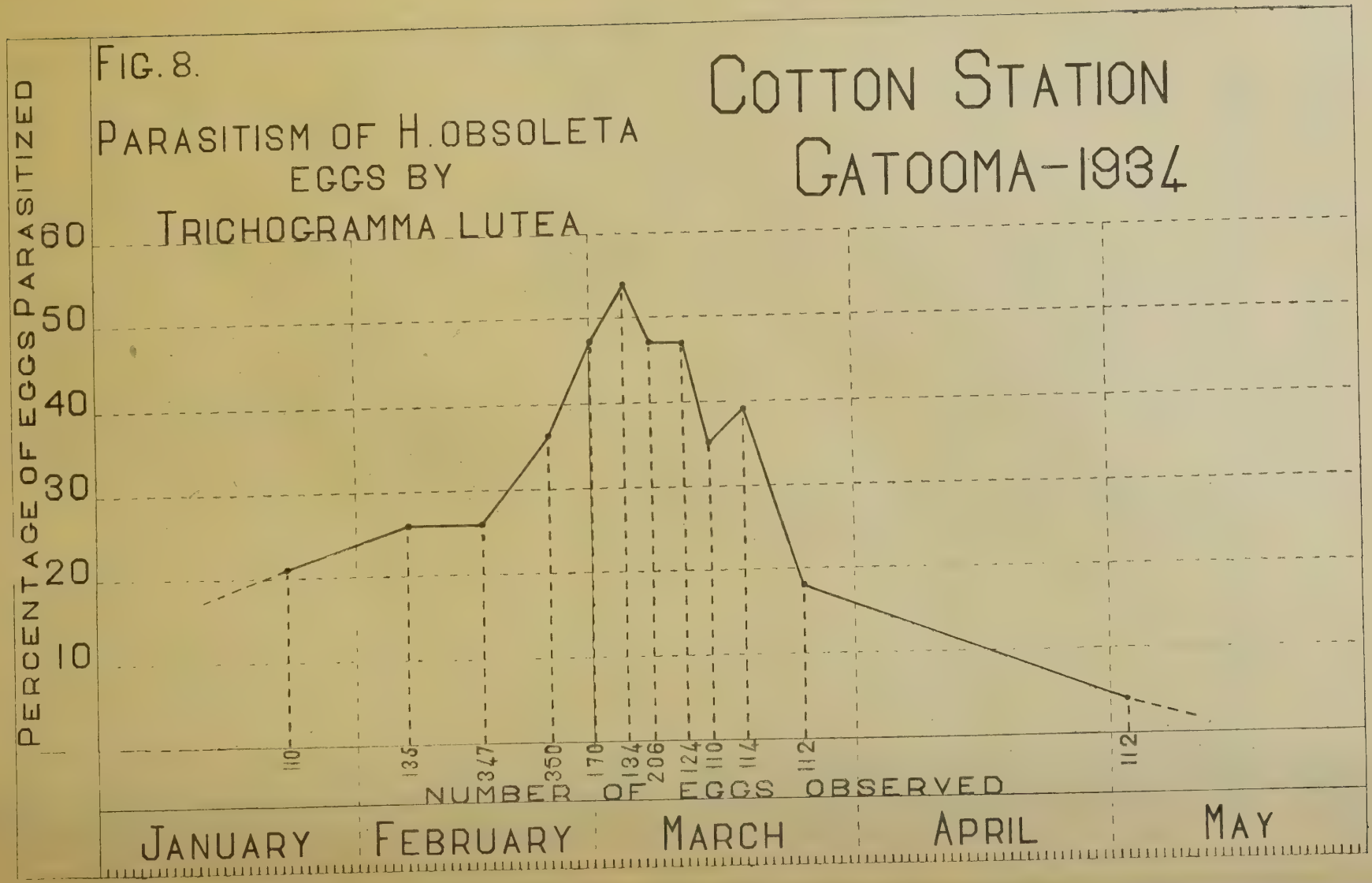


FIG. 8.
PARASITISM OF H. OBSOLETA EGGS BY TRICHOGRAMMA LUTEA
COTTON STATION
GATOOMA-1934
PERCENTAGE OF EGGS PARASITIZED
60
50
40
30
20
10
110
135
347
350
170
134
206
124
110
114
112
112
NUMBER OF EGGS OBSERVED
JANUARY
FEBRUARY
MARCH
APRIL
MAY

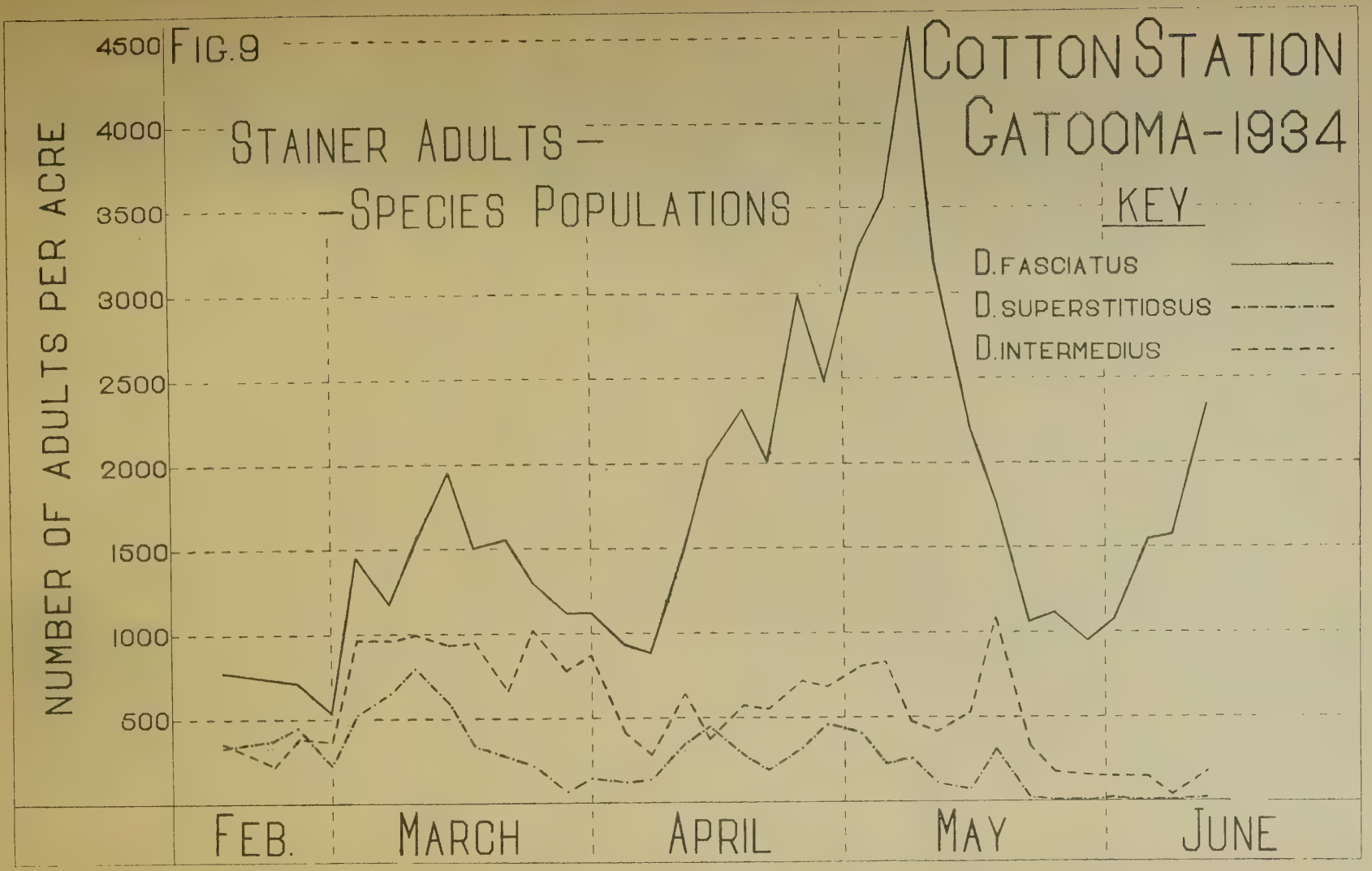
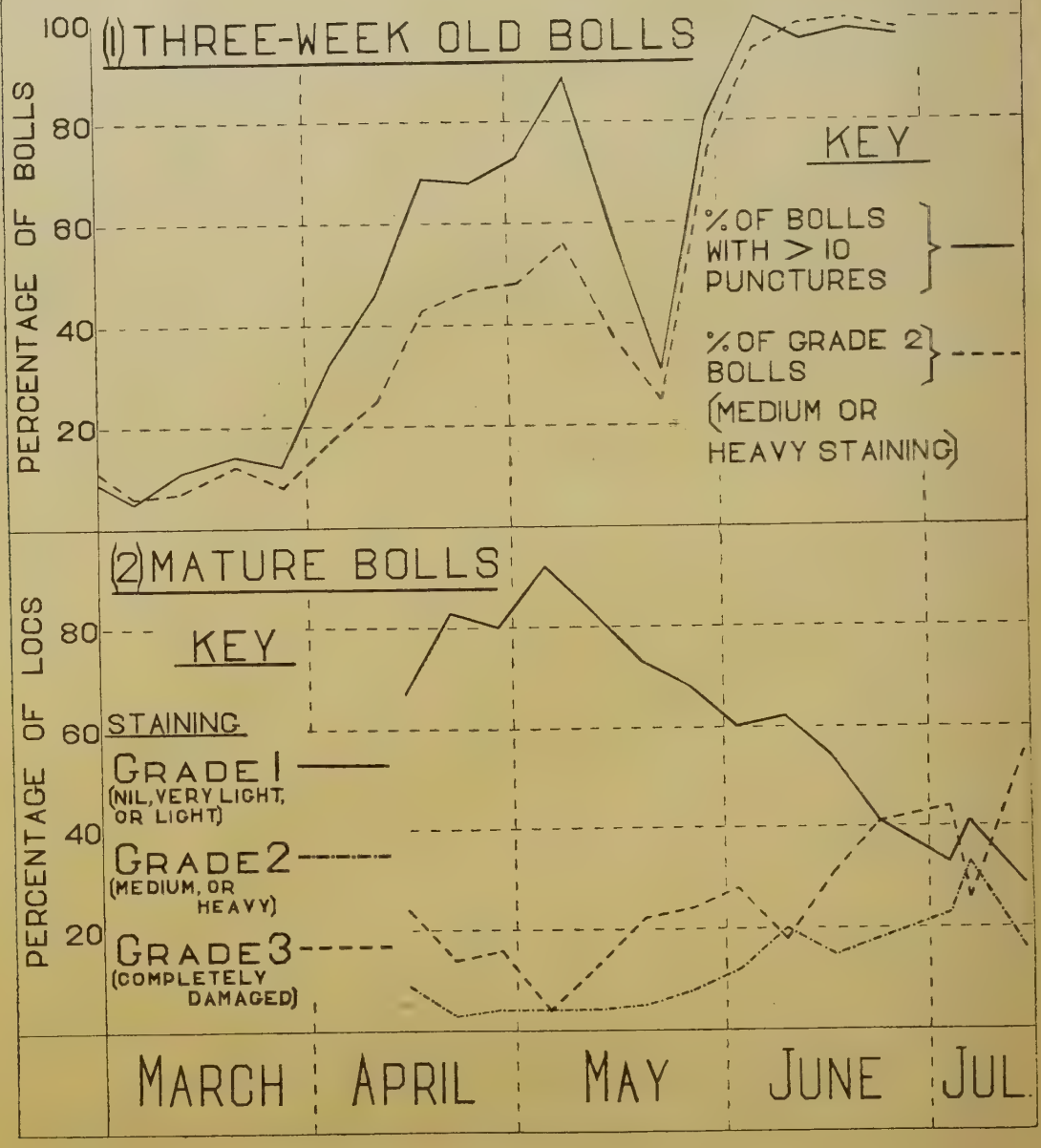


FIG. 9
COTTON STATION
GATOOMA - 1934
STAINER ADULTS —
— SPECIES POPULATIONS
KEY
D. FASCIATUS
D. SUPERSTITIOSUS
D. INTERMEDIUS
NUMBER OF ADULTS PER ACRE
4500
4000
3500
3000
2500
2000
1500
1000
500
FEB.
MARCH
APRIL
MAY
JUNE

FIG. 10.

COTTON STATION CATOOMA - 1934

STAINING



Nearly six tons of seed of these two strains have been issued to growers for the coming season. The demand for seed from the Station greatly exceeded the amount available. A total of about fourteen tons would have been available had it not been for an unfortunate fire in the seed cotton dump before ginning, which reduced this amount by more than half. Fortunately only small quantities of the newer lots were destroyed, and no strain was completely lost.

Though relatively good stocks, both /64/7/10 and /64/V have faults. The former matures earlier than /64/V and is more open and slightly lighter wooded, very important characters in view of what is known about American bollworm attack, but it has not such good jassid resistance; further, it has a lower ginning percentage, and does not give lint of such good character as the /64/V lint.

Substrains, especially of /64/7/10, show improvement on the parent stocks in some of the qualities in which the latter are not too satisfactory. A range of excellent substrains, multiplied under conditions not optimum, were yielding at the rate of 1,000 to 1,200 lbs. of seed cotton per acre. They represent excellent breeding material, and are being multiplied and tested throughout the country this coming season.

The contrasting behaviour, in a favourable season, of two "possible" /64 types is of interest; as the season advanced, the one strain deteriorated and the other improved markedly owing to differences in the way in which they finished their crop. U.4/64/1/2 (G.5, 24), about the middle of the season, looked one of the most spectacular of the lots, but it proved to be a poor finisher. It is quite an early, big-bolled, fairly vigorous strain with high lint quality. In contrast, U.4/64/7/1/1 (G.5, 28), and its derivatives, very open, somewhat lax, /64 types, as in the previous season, improved in appearance out of all recognition as they finished their crop.

As indicating the trend of selection work this coming season, it may be mentioned that out of 13 "possibles" at the bulk stage for further multiplication and testing, 11 are /64 derivatives, and of these, 7 are derivatives of /64/7/10. These are survivors, on merit, of a large number of selections from a range of strains. About 500 re-selections are being planted; 78% are derivatives of /64, and of these 40% are derivatives of /64/7/10.

The last few seasons have been seasons of moderate or low rainfall. It remains to be seen how strains will respond in jassid resistance, style of growth, and fruiting, to a really wet year.

In the families other than /64, only U.4/26/B/2 (G.2, 26) has made anything approaching a satisfactory showing against the /64 derivatives. /26/B/2 is an early maturing strain, fruiting freely, but with only

moderate lint quality. In the /34 family the very excellent jassid resistance was maintained, but the late habit and plant size appeared to be the cause of the strain suffering very severely from American bollworm attack. The opening was not satisfactory ; the yields were relatively poor, and the lint quality was not too good. The /78/3 lots behaved in a similar fashion. No one of the derivatives of these strains was at all comparable with the better /64 lots.

Very distinct differences showed up in the degree to which strains suffered from American bollworm, and the use of strains less attractive to it for egglaying, and suffering less from its attack, is an important aspect of the American bollworm problem. Under the type of attack experienced on the Station for the last year or two, the better /64's carried through a relatively heavy crop, where most of the other families suffered quite badly. Apart from other factors, there also appeared to be a significant difference this last season in the attraction of strains to American bollworm egglaying, which appeared to be significantly heavier on the slightly late, more vigorous, fairly leafy strains of the /34 and /78 type. Egg counts will be made this season on groups of plants of /64 and /34 stocks in adjoining bulks, to study in more detail differences in attraction.

Loss in the /34 and /78 types showed up clearly as much heavier than in the better /64 lots, in plots of at least moderate size. But in the relatively small plots in the strain trials these differences seemed to be obscured, and there were not the yield differences there that showed up in the larger bulk and observation plots. This is a real difficulty in comparing in strain trials the yields of strains of different habit. Partly for this reason, and partly because the initial good stands were seriously reduced by white ant damage, the strain yield-trials did not bring out satisfactorily yield differences for the season. Neither of the strain trials laid down gave significant variations due to " treatments " under the " Z " test. As it could be seen that these trials would not be satisfactory, in addition to obtaining yields from all the observation plots and single plant lots, both at close and at wide spacing, in the bulks, as well as the total yields, " pilot lines " in a scatter through each bulk were picked separately and weighed, to give some idea of the variations in strain yield under different conditions.

Only a portion of the work of lint examination for the season has so far been done. On the whole, /64/V lint is of higher quality than that of the /64/7/10 lots, and the /64/V lots gin out better. Within the /64/7/10 lots, certain of the strains promise improvement on the parent stock in these qualities.

The majority of the substrains and re-selections now being grown have a staple length of bare $1\frac{1}{8}$ inch to full $1\frac{1}{8}$ inch. The important classification is for strength and character. The aim of the selection and breeding work being the production of an early and fairly quick crop, as a factor in reducing American bollworm and stainer damage, there is the danger, under difficult conditions, of producing lint deficient in these respects, and they are consequently amongst the first qualities considered in the lint comparisons of various strains.

With a heavy crop and a larger acreage than usual under cotton, picking was spread out this year over a longer period than normally, and the deterioration caused to the lint by being left on the plants longer than is necessary, was more clearly seen than in former years. Not only does actual lint quality deteriorate by the weathering, but fragments of broken leaf become mixed up with the seed cotton, lowering its value and making it more difficult to pick.

188 of Harland's crosses of U.4 with Cambodia, Jamaica Xerophytic, and Gambia 14, were grown. Only the group, U.4 × Cambodia backcrossed on to U.4, showed any promise under Gatooma conditions. The great majority of the strains in the other groups showed poor jassid resistance and were unproductive. Twenty-three lots are being carried on for further trial.

A number of Station crosses were made, using highly jassid-resistant /34's to bring greater jassid resistance into some of the better /64 lots.

Spacing.—Spacing results agree with the results of the last few years. For most soils a fairly close spacing of 6 inches to 12 inches in the row gave the best results. Where the soil was richer, a slightly wider spacing gave equally good results. Table I gives the results of one spacing trial on the Station. A second spacing trial under different conditions did not show a significant variation due to " treatments " under the " Z " test.

TABLE I.

INTRA-ROW SPACING TRIAL.

	1–6″.	1–12″.	1–24″.	2–24″.	*Criterion of significance* P=·05.
Equivalent yield, lbs. of lint per acre ...	289·5	255·1	240·4	257·9	26·0
Percentage on mean yield, lbs. lint per acre	111·0	97·8	92·2	98·9	10·0

SOIL AND TREATMENT.

Under the droughty conditions of late February–early March, especially in Mazoe and Lomagundi, cotton crops on the poorer types of land suffered more heavily than the crops on land in fair heart.

But quite poorish land, in which a green manure crop had been ploughed in the previous year, gave good results.

Owing to the heavy vegetative growth obtained and the lateness induced, crops on heavy rich land are specially attractive to egglaying American bollworm moths. For this reason it is safer at present not to use this type of land for cotton. If cotton is to be planted on such land, earliness is of the greatest importance.

On the Station, little or no response could be seen from the direct application of fertiliser dressings up to the equivalent of 800 lbs. per acre of superphosphate plus 300 lbs. per acre of nitrate of soda. In other areas, however, crops were seen where increased yields appeared to have resulted from the application of superphosphate. As cotton responds to phosphatic applications to previous crops on the Station, on moderate to poorish land, the general practice is to apply raw rock phosphate to the green manure crop, generally sunnhemp, and to follow the green manure crop with cotton. The results appear satisfactory.

NORTHERN RHODESIA.

RESEARCH STATION, MAZABUKA.

PROGRESS REPORT ON THE COTTON WORK, SEASON 1933-34.

BY

A. G. BEBBINGTON (*Empire Cotton Growing Corporation*) AND W. ALLAN (*Northern Rhodesia Department of Agriculture*).

Season.

Growing conditions during the season may be described as having been almost perfect. The rains were evenly distributed and moderate in their fall with the result that good growth was made by the plants.

On the other hand, from the point of view of insect pests, the season can only be regarded as a catastrophe. Observations during January and February were seriously hampered by the necessity for spraying operations against large bands of hoppers of the red locust (*Nomadacris septemfasciata*). During the latter month a mass movement of hoppers from the Kafue Flats commenced, necessitating spraying over a front of seven miles. This movement continued throughout the month, but was successfully checked. Flying swarms visited the Station on practically every day in March, but the cotton was successfully defended by smoke screens and the use of flags and tins. Defoliation of the maize crops led to a cessation of egglaying by the American bollworm moth, with the result that some records were incomplete.

American bollworm appeared in the crop in February, and assumed very serious proportions in March and April. The plants were completely stripped of their early crop and for a period of one month from mid-March to mid-April, no flowers were recorded. This resulted in the destruction of the season's crop—only sixteen pounds of seed cotton per acre being harvested, as opposed to seven hundred and fifty pounds per acre last season.

A heavy influx of stainer (*Dysdercus*) took place in February, but during the period of maximum bollworm activity practically disappeared, reappearing in May when flowering had commenced again.

Jassid appeared in large numbers during the early part of the season but caused no appreciable damage to the resistant strains.

Cotton Experiments.

Yield Trials.—A strain trial of eight strains of U.4 laid out in a randomised block with eight replications was carried out. No conclusions can be drawn from the results as the plot yields were too small on account of bollworm damage.

Spacing Trial.—A trial of three spacings, laid out in a randomised block with ten replications, failed to give any results for the same reason.

Selections.—Eighteen single plants were carried forward from the previous season, together with four strains from Barberton and eight from Gatooma. Practically no crop was obtained from these and no selection work could be carried out on them owing to the poor quality of the late crop and the distortion of habit due to excessive vegetative growth.

Six groups of various crosses, comprising 195 strains in all, were received from Dr. Harland, Cotton Research Station, Trinidad. The severe jassid attack in February and March was of value in sorting out susceptible types, and 101 were discarded on this ground. No further selection was possible owing to the damage caused by bollworm.

Seed Distribution.—Seed sufficient for the planting of over 300 acres was issued to 13 farmers. A large proportion of this was mixed seed to be put in for cattle feed, but very little of it was planted. Ten farmers had from 5 to 10 acres each of U.4/2 which has proved the most successful strain over the past three years. All these plots were severely affected by bollworm and yields were negligible.

Outside Plots.—Four plots were planted in a native area, mainly to ascertain the effect on the stainer population of a very much decreased wild host plant population, but also partly to explore the possibilities of native cultivation of the crop. The plots were situated on Karroo sand which on analysis shows 90% sand, of which 50% is fine sand. The plants grew very well and gave heavy yields of good quality cotton. It is proposed to increase the number of these plots in the coming season.

Insect Work.

Stainers.—Seasonal distribution counts were continued as in previous seasons, but based on a new method devised in conjunction with other workers at Barberton. This was duplicated on a neighbouring farm.

The usual early influx of *D. superstitiosus* occurred, but in very much larger numbers than in previous years. The distribution of stainer on the Station was upset owing to the loss of crop caused by the American bollworm. *D. fasciatus*, which had appeared in the crop in

small numbers in February and March, disappeared in April, and did not reappear until the plants began to set a late crop towards the end of May. On the other hand, on the neighbouring farm where the loss of crop was considerably less, the distribution followed its usual course. *D. intermedius* appeared only in negligible numbers.

Preliminary investigations into the causative agents of internal bollrot would appear to show that early staining is caused by bacteria, while *Nematospora* does not appear in the crop until later, probably being correlated with the appearance of *D. fasciatus*.

The study of the fluctuation of *Dysdercus* population on *Thespesia rogersii* was continued. Nineteen groups of trees, scattered within a radius of two miles of the Station, were observed weekly. The population of *D. fasciatus* on these trees has been at a minimum during this season. This was apparently due to the complete loss of crop on the majority of the trees caused by the larva of an unidentified Cossid moth.

Observations during the present season have confirmed the view that *D. superstitiosus* exhibits a marked preference for annual herbaceous hosts, and records have been taken regularly on a large number of wild *Hibisceæ*. These include the following species: *H. asper*, *H. cannabinus*, *H. articulatus*, *H. rosa-sinensis*, *H. trionum*, *H. dongolensis*, *H. hastifolius*, *H. panduriformis*, *H. Baumii*, *H. esculentus*. Of these *H. cannabinus*, *H. asper* and *H. trionum* were the most important during the present season.

The Ecological Survey has continued to provide valuable information on the distribution of wild host plants and the incidence of stainer on them. In this connection it is interesting to note that in the Zambesi Valley, in May, the following distribution of the three species of *Dysdercus* was observed. *Andansonia digitata* and *Thespesia rogersii* were carrying *D. fasciatus* only; various species of *Hibisceæ*, *D. superstitiosus* only; while *D. intermedius* was found only on *Sterculia triphaca*.

As stated in the report for 1932–33, a series of plots of cotton was arranged to be grown at various distances from areas where host plants were known to occur. It was not possible to obtain continuous records on these plots as they are situated 120 miles from the Station. The four plots were visited in May and three were found to be carrying a population of the three species of *Dysdercus*. In the case of one plot, planted in an area where *Thespesia rogersii* and *Sterculia triphaca* occurred in close proximity, heavy staining comparable with that at Mazabuka had occurred. A second plot, believed to be about four miles distant from host plants, was slightly stained. It was found, however,

that a number of large bushes of kidney cotton occurred near the village. The third plot, some three miles distant from known host plants, showed no staining, although stainer was present. It would appear probable that *Dysdercus* had arrived too late to do any damage. In the fourth plot, which was four miles from the nearest known host and entirely surrounded by *Isoberlinia* bush, no stainers were observed and the crop was clean.

Further sites have been chosen in collaboration with Mr. C. G. Trapnell, of the Ecological Survey, for the season 1934–35, and it is proposed to station native recorders in each district. These sites have been chosen with a view to obtaining as great a freedom as possible from wild host plants.

Bollworm.—The attack of American bollworm (*Heliothis obsoleta*) developed on the Station early in February and became extremely serious in March and April. The plants were completely stripped of all crop, the final yield obtained being only sixteen pounds of seed cotton per acre.

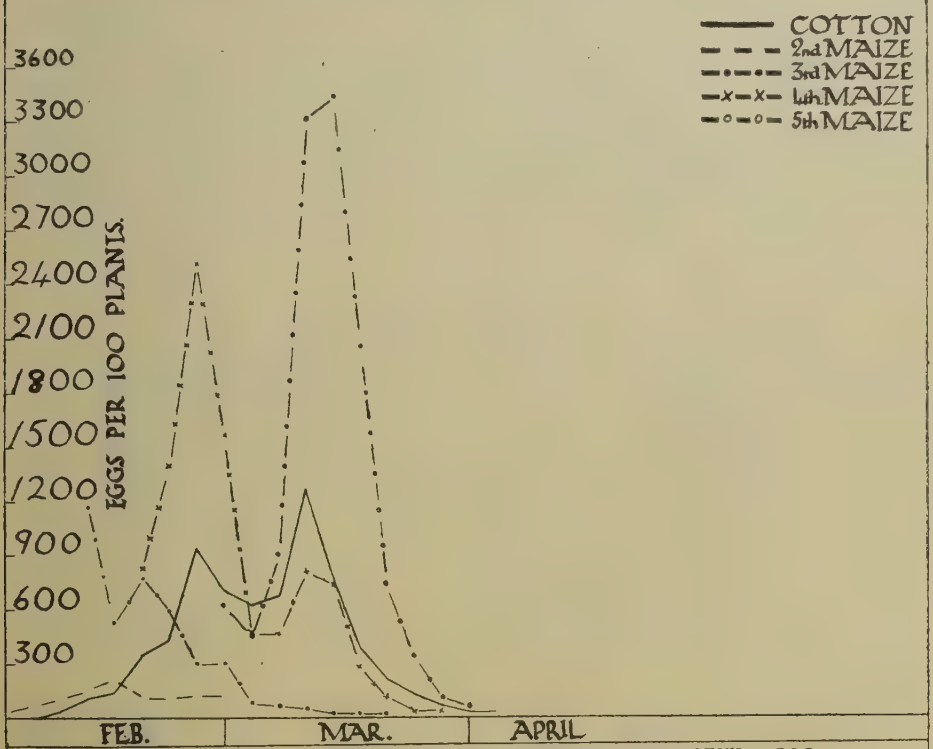
An attempt was made to verify the findings of workers at Barberton, with regard to the use of maize as a trap crop, the method being carried out both on the Station and on a neighbouring farm.

Four plantings of maize at twenty-one day intervals were used on the Station, and five rather irregular plantings on the farm. Egg counts were carried out twice a week on both cotton and maize. Twenty plants per acre, chosen at random over five acres, constituted a sample. The counts carried out during February were of little value, as the native staff employed was then unaccustomed to the work. The later figures can, however, be regarded as reliable. The results of the counts are given in Figs. 1 and 2. They confirm the fact that maize is most attractive to the bollworm moth when tasseling is taking place.

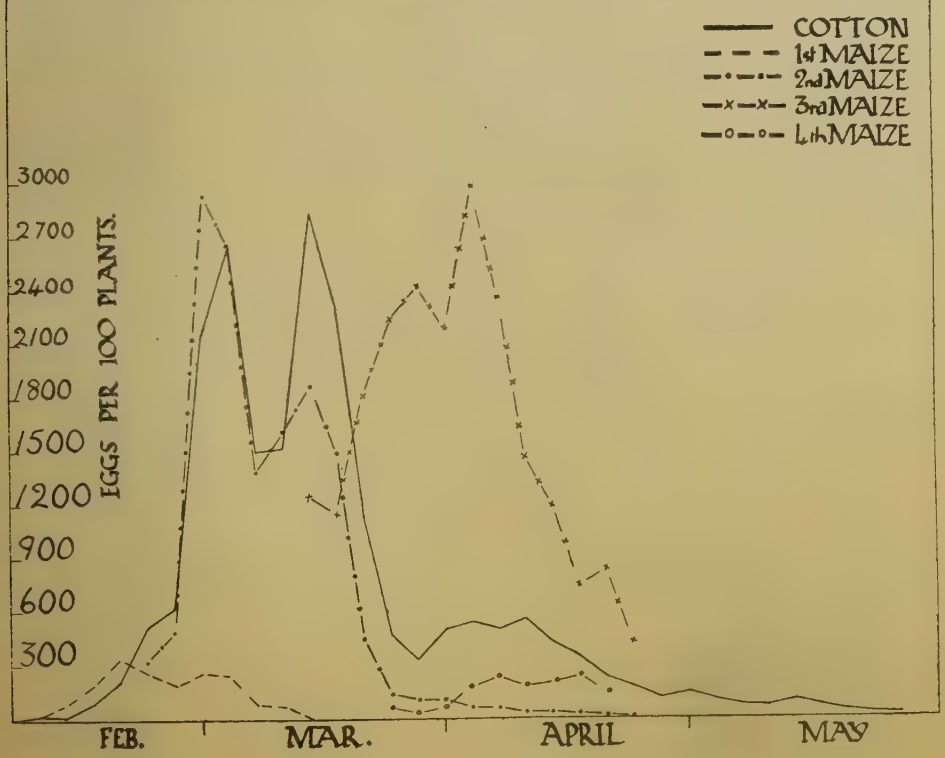
The main point which emerges from these results is that the maize traps failed to hold the moth and to prevent serious damage to the cotton. It must be remembered, however, that an American bollworm attack on the scale of the present season has not occurred in any of the previous years for which records are available. Reports of heavy infestation of maize and sorghum crops were received from many areas near the railway. In every case where cotton was grown without trap crops the crop was completely destroyed.

It is of interest to note in this connection that in the plots used for stainer observations, grown by natives, no damage by *Heliothis* was observed. It may be that the multiplicity of crops grown by the native with their different flowering periods proved more attractive to the moth.

COURSE OF OVIPOSITION BY HELIOTHIS OBSOLETA ON COTTON AND MAIZE ON FARM 1934 -:- FIG 1



COURSE OF OVIPOSITION BY HELIOTHIS OBSOLETA ON COTTON & MAIZE ON STATION 1934 -:- FIG 2



The results obtained on the Station and on the farm were not entirely in agreement. The counts on the farm were stopped at the end of the first week in April owing to defoliation of both the maize and the cotton by locusts. Counts on the Station were continued until the end of May. The period of recording was thus some six weeks longer than on the farm, but this did not significantly affect the difference between the totals of eggs recorded.

TABLE I.

Place.	*Eggs recorded.*		
	Total eggs.	*Eggs per acre of cotton.*	*Eggs per acre of maize.*
Station	75,882	1,747,000	757,000
Farm	38,756	593,000	536,000

As the number of maize plants on which records were taken was double the number of cotton plants, the actual figures have been given as eggs per acre, in order to render them comparable. It may be stated that the spacing was the same in both crops.

The difference between the egglaying on the cotton on the Station and on the farm was reflected in the final yields which were 16 pounds and 60 pounds of seed cotton per acre respectively.

The heavier layings on the cotton on the Station may be accounted for by the following facts :—(1) The total laying on the Station was very much heavier. (2) The layout of maize and cotton entailed the flighting of moths over the cotton when moving from one maize crop to the next.* (3) The Station maize was very irregular in growth, thus only a portion of the trap crop was attractive at any one time, while that on the farm came into tassel uniformly.

Egg collections were taken twice a week on both cotton and maize and examined for parasitism, records of hatching also being kept. The figures obtained are given in Table II.

TABLE II.

Place.	*Cotton.*			*Maize.*		
	Total eggs Collected.	*Total hatched.*	*Total parasitised.*	*Total eggs collected.*	*Total hatched.*	*Total parasitised.*
Station	1,717	648	195	1,067	441	344
% of total	—	37·5%	11·3%	—	41·3%	32·2%
Farm	480	146	83	589	238	153
% of total	—	30·4%	17·3%	—	40·4%	25·9%

As may be seen from the above figures, parasitism was consistently higher in maize than in cotton. Two parasites were separated out, of which by far the more abundant has been identified as *Trichogramma lutea.*

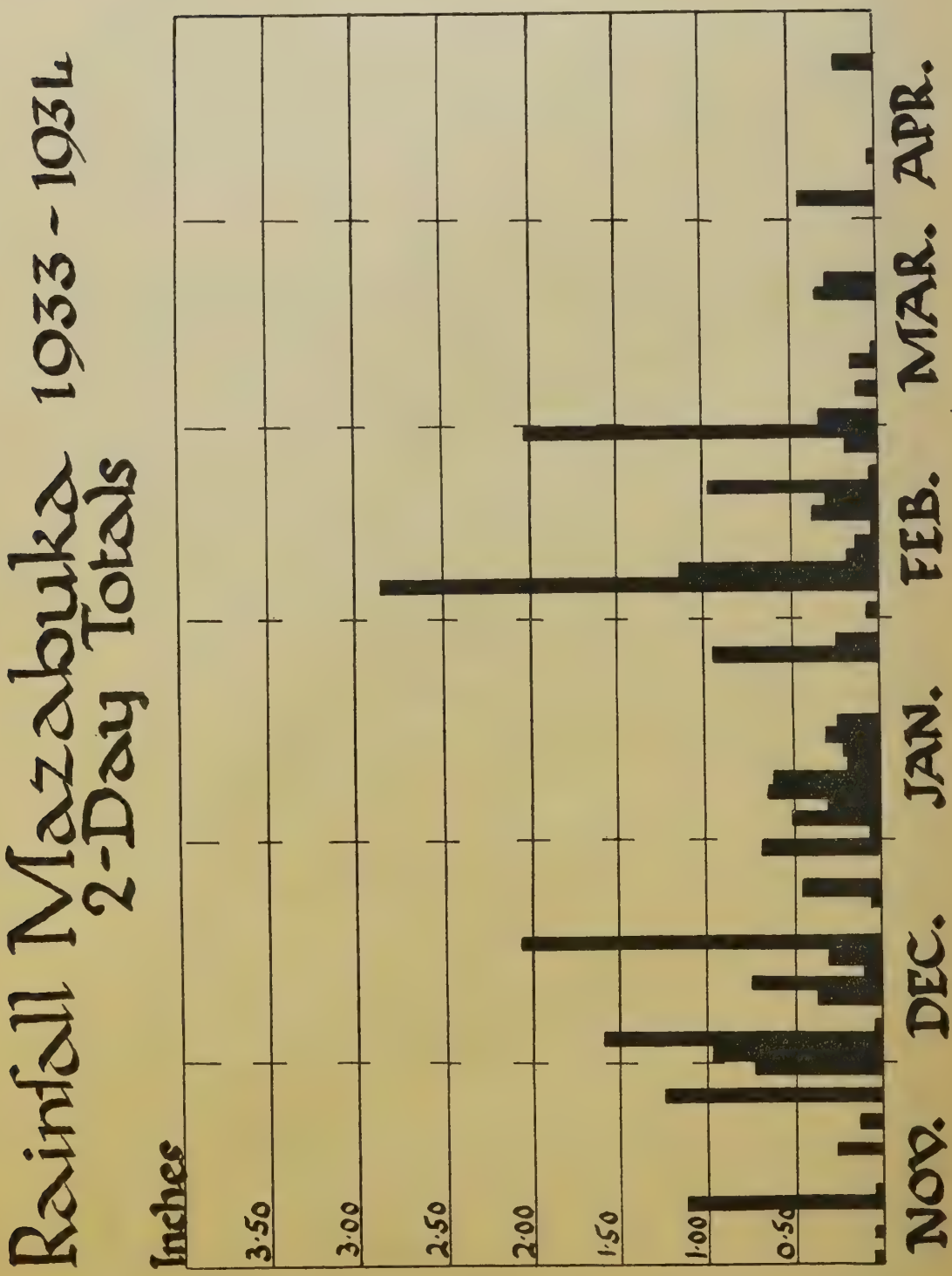
*Work carried out at Barberton has shown that laying may take place on cotton during such flights.

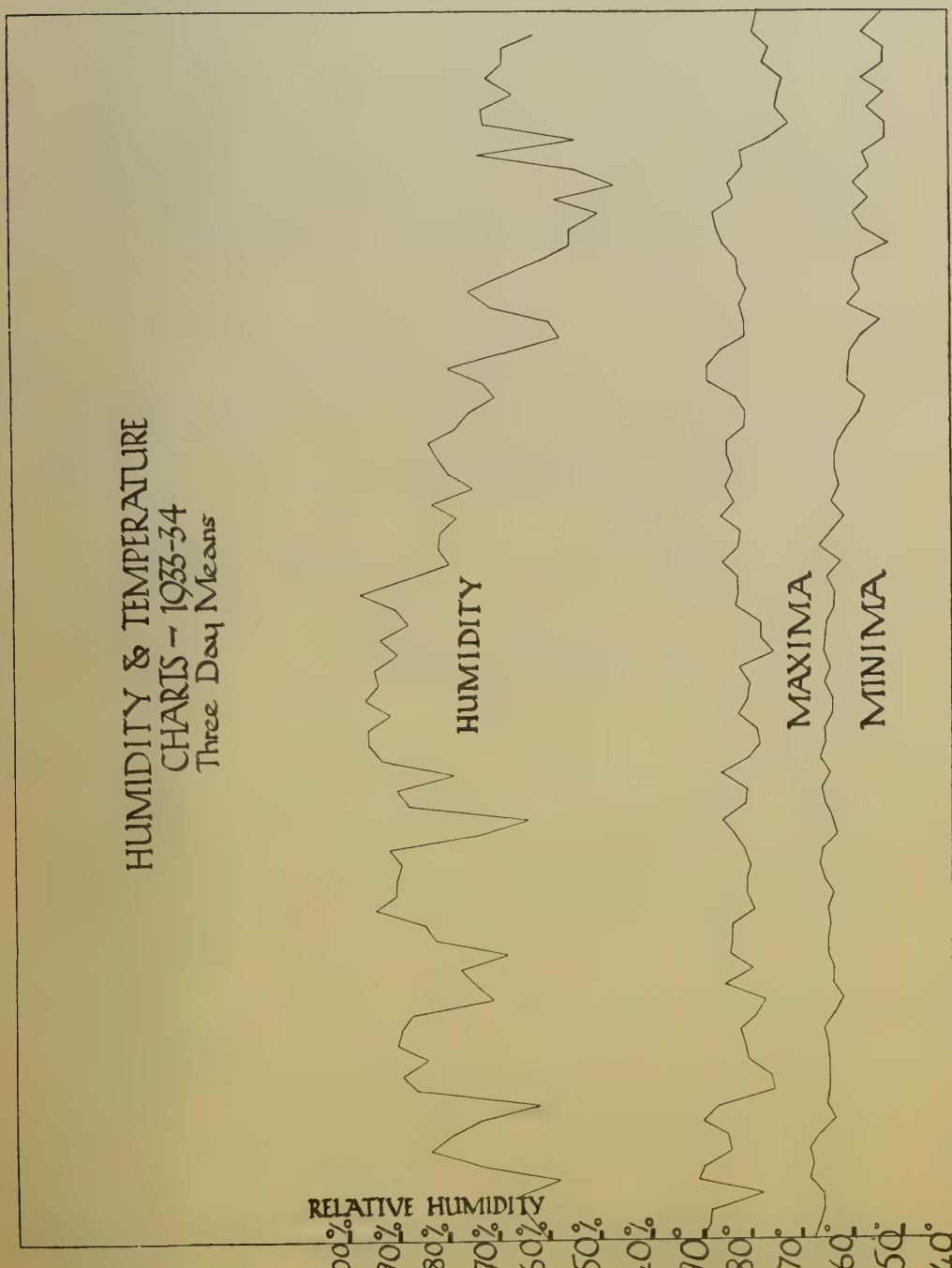
DAILY RAINFALL.

Season 1933–1934.

	July.	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May.*	*June.*
1	—	—	—	—	—	0·40	0·05	—	1·88	—	—	—
2	—	—	—	—	0·01	0·88	—	0·07	0·34	—	—	—
3	—	—	—	—	—	0·72	0·50	Tr.	—	0·19	—	—
4	—	—	—	—	—	0·02	—	—	—	0·23	—	—
5	—	—	—	—	0·04	—	0·16	—	—	—	—	—
6	—	—	—	—	—	—	0·14	2·79	0·11	—	—	—
7	—	—	—	—	—	—	0·60	0·05	Tr.	—	—	—
8	—	—	—	—	—	0·34	0·02	Tr.	Tr.	—	—	—
9	—	—	—	—	0·15	—	0·38	1·12	—	0·02	—	—
10	—	—	—	—	0·96	0·04	0·22	0·16	Tr.	—	—	—
11	—	—	—	—	—	0·67	0·18	0·02	0·16	—	—	—
12	—	—	—	—	0·02	—	—	0·03	0·01	—	—	—
13	—	—	—	—	—	0·08	0·18	0·09	—	—	—	—
14	—	—	—	—	—	0·08	0·02	—	—	—	—	—
15	—	—	—	—	—	0·23	0·24	0·02	—	—	—	—
16	—	—	—	—	Tr.	0·05	0·06	0·36	—	—	—	—
17	—	—	—	0·03	0·27	2·00	0·23	Tr.	—	—	—	—
18	—	—	—	—	—	—	0·02	0·30	—	—	—	—
19	—	—	—	—	Tr.	—	—	—	—	—	—	—
20	—	—	—	—	—	—	—	0·43	0·21	—	—	—
21	—	—	—	—	0·11	—	—	0·55	0·15	—	—	—
22	—	—	—	—	Tr.	—	—	0·03	0·30	—	—	—
23	—	—	—	—	—	0·04	—	Tr.	—	0·22	—	—
24	—	—	—	—	—	0·05	—	—	—	—	—	—
25	—	—	—	—	1·25	0·37	—	—	—	—	—	—
26	—	—	—	—	—	—	—	0·11	—	—	—	—
27	—	—	—	—	—	—	0·15	0·08	—	—	—	—
28	—	—	—	—	0·71	—	0·82	0·13	Tr.	—	—	—
29	—	—	—	—	—	—	0·18	—	Tr.	—	—	—
30	—	—	—	—	0·57	0·52	0·03	—	—	—	—	—
31	—	—	—	—	—	0·14	—	—	—	—	—	—
	—	—	—	0·03	4·09	6·63	4·18	6·34	3·16	0·66	—	—

Total for the Season, 25·09 inches.


Rainfall Mazabuka 1933 - 1934
2-Day Totals
Inches
3·50
3·00
2·50
2·00
1·50
1·00
0·50
NOV. DEC. JAN. FEB. MAR. APR.


HUMIDITY & TEMPERATURE
CHARTS – 1933-34
Three Day Means
HUMIDITY
MAXIMA
MINIMA
RELATIVE HUMIDITY
100%
90%
80%
70%
60%
50%
40%
90°
80°
70°
60°
50°
40°
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY
JUNE

ANGLO-EGYPTIAN SUDAN

PROGRESS REPORT ON THE WORK ON COTTON CARRIED OUT BY THE PLANT BREEDING SECTION, GEZIRA AGRICULTURAL RESEARCH SERVICE, SEASON 1933-34

BY

TREVOR TROUGHT.

General.

(i) *Climate.*

The rainfall was little more than one-third of that of the previous season, and amounted to 78·4 mms., spread over 27 days. The average rainfall for the last seven years is 168 mms., ranging from 56·7 mm. to 279 mm. per annum.

In the months of August and September, and again in December, maximum temperatures were above normal. From January to April the weather was cooler than usual. The percentage relative humidities were comparatively low in the early part of the season and rather higher in November and December.

(ii) *Development of the Crop.*

(*a*) *At Shambat.*

The early stages of the crop, both Egyptian and American types, seemed promising. July-sown Egyptian types (Roguing plots) were well forward, flowering heavily and growing strongly in October. For cottons sown at the normal time, the records taken showed that growth in height was slower than in the previous year, though there was little difference in the final height reached. A check occurred about the beginning of December. Little secondary growth took place, possible because of the cooler weather in the latter part of the season.

Records of flowering were similar to those of the previous year, but bud-shedding was less and boll-shedding considerably more than last year, particularly in December, 1933.

Final yields, partly on this account and partly on account of a very heavy pink bollworm infestation, were unsatisfactory. On one plot (X04729) pink bollworm attack reached over 90% in the green bolls at the end of January, 1934.

The American breeding plots also suffered severely from jassid attack.

(*b*) *At other Stations.*

Replicated varietal tests were grown in the Gezira area (Gezira Research Farm and Barakat Seed Farm), in Berber Province (Gandeto Pump Scheme, Shendi), the Nuba Mountains (Talodi and Kadugli), and Mongalla (Opari and Kirrippi).

In the Gezira area yields were below normal, white ant attack and wilt being particularly serious on the Research Farm.

In the Nuba Mountains the yield per acre was well above average ; in Mongalla average yields were obtained, but in Berber Province a severe pink bollworm attack caused appreciably reduced yields.

Experimental.

A. *Pedigree Line Breeding and Hybridization.*

(i) *Egyptian (and Sea Island) Types.*

The results obtained with X1530 in large-scale comparative trials, reported last year, together with the indications as the season progressed that these results would be confirmed this year, called for a raising of the standard of comparison for selection work, and X1530 was taken as this standard. The " control families " in the breeding plot had, however, been sown with Gezira Main Crop Sakel.* Although these families had lost their function as a standard it was hoped they would serve as a guide to the severity of leaf-curl infection in the breeding plots, and they actually showed an average infection of 81·3% by the end of the season. The Hybrid and Pedigree Line families also showed a high percentage of leaf-curl infection at Shambat. Comparisons with the parallel cultures at the Gezira Research Farm (where the intensity of the disease was light) showed considerable discrepancies in the degree of infections, and it was clear that, in addition to percentage infection figures, field observations on the degree of severity of attack were required in order to judge whether families were leaf-curl-resistant or not.

Wilt appeared in the plots and a number of families were discarded as being insufficiently resistant to wilt.

Attempts to discover an Egyptian-type plant immune to blackarm were continued in conjunction with the Government Botanist, but without success. Future work will be directed to finding *resistant* types, to serve as a basis for hybridization and back-crossing work, as complete immunity seems very rare, if not non-existent.

The X1530 and X1730 types, in general, showed considerable vegetative purity ; the improvement of lint quality is the main direction of work with these types.

*Referred to throughout this Report under the initials G.M.C.

Vigorous growth was obtained in X04729 and " Gash Sakel " types. An increase in leaf-curl resistance is desirable, however. A leaf-curl resistant selection from Sakel (NT3/33) showed great purity for a characteristic vegetative habit and high-yielding capacity ; the lint, though long enough, was a little rough.

Hybridization and back-crossing, particularly of Ishan on to Sea Island, Sakel, and Sea Island × Sakel hybrids occupied more time than usual. A number of large F_2 families were grown and were rather disappointing. The natural seed of one of these families sown at Medani was decidedly attractive. It was noticed that in most families, plants from self-bred seed were not quite so vigorous in growth as plants from natural seed, and as the F_2 families were all from self-bred seed of the F_1, this effect may account for their disappointing appearance.

Of the older established hybrids, one family of a Sakel × Sea Island cross was promising.

As in previous years, the majority of the families at Shambat were duplicated in parallel cultures at Medani. Detailed inspections were made on these cultures to assist in selection. It is important that a family should show satisfactory vigour at both places.

(ii) *American Types.*

The number of Hybrid and Pedigree Line families sown this year was much larger than in previous years. Out of the 119 families sown, 56 were from samples sent by Dr. Harland from Trinidad for trial. 130 more samples from Trinidad remain for trial in succeeding years.

A severe jassid attack on these plots caused disappointing growth, but allowed of notes being made on resistance to jassid. Among Harland's hybrid families there were considerable differences in the severity of the effect, even among families which were descended from U.4 and Cambodia parents only. Pedigree Dixie × Lone Star hybrids proved susceptible, and Pedigree Dixie families (which are hairy types) proved also to be susceptible. "513" (a type bred for jassid resistance) and " 514 " (selected from Pump Scheme Strain) showed satisfactory resistance, but certain U.4 families were not so good.

Mr. H. C. Ducker kindly tested some strains in Nyasaland for jassid resistance. He considered XA129 and " 514 " better than the others. XA1129 was not sufficiently resistant for Nyasaland conditions, while XA02629 (Columbia selection) and Webber were definitely susceptible. (" 513 " was not sent.)

Two plots of a blackarm-resistant type were grown from seed sent by Mr. G. W. Nye of Uganda. These were sprayed with a *B. malvacearum* suspension by the Government botanist and proved

practically immune to blackarm.* Adjacent plots, similarly sprayed, were 100% susceptible. Crosses were made between these immune types and "513" and "514" strains.

Five plots of U.4 selections received from Mr. Ducker were grown, and selections made from them.

A few "parallel cultures" were grown at Talodi and Kirrippi, but the germination was poor and insufficient seed was available to fill the gaps. Under the present system it is doubtful whether it is worth continuing "parallel culture" work in the South, owing to the impossibility of providing expert supervision. With the growing importance of the Nuba Mountains crop, it seems very desirable to establish a field laboratory there, with a plant breeder in charge throughout the growing season.

B. *Cotton Propagation.*

(i) *Egyptian Types.*

(*a*) *At Shambat.*

(i) Twenty feddans were grown of X1530A (a direct selection from X1530) and 14¼ feddans of X04729. The latter type is a selection for lint of Sakel quality, but rather longer staple, in a family of Burd's B.D. (Sea Island) in 1927/28. Yields of both these promised to be good, but a severe pink bollworm attack reduced the final yield considerably, particularly in the plot of X04729. X1530A yielded 3·8 large kantars† and X04729 2·9 large kantars of seed cotton per feddan.

(ii) A "nucleus roguing plot" of two feddans of X730 gave 4·15 large kantars of seed cotton per feddan.

(iii) In order to obtain sufficient seed for testing, small plots of X1530B, X1530C, 508A (a fixed Sakel × Sea Island hybrid) and NT2/33 (a selection from Sakel grown in the Gash Delta) were grown.

(*b*) *At the Gezira Research Farm.*

A propagation area of 1½ feddans of Lecrem was grown and gave a final yield of 3·4 kantars per feddan.

(*c*) *In the Gezira Area.*

A further step in the multiplication of X1530 seed was taken this year, when 773 feddans were grown on areas in the Northern, Central and Southern Gezira. In spite of dusting the seed with Abavit B (a

*This immunity has been retained in the 1934–35 season.

†1 large kantar = 315 rotls.
1 small kantar = 100 rotls.
1 rottle. = ·99 lb.
1 feddan = 1 acre (approx.).

poisonous mercury compound dust), blackarm was serious in the early stages of growth. The plants made a very good recovery, although the season was, on the whole, unfavourable to Sakel, and an average yield of 4·46 large kantars per feddan was obtained (compared with an average Sakel yield for the whole Gezira of 2·3 kantars per feddan).

This apparently greater susceptibility of X1530 to blackarm in its early stages might be caused by a constitutional factor, or might have been due to the seed used having been so badly attacked by pink bollworm that the normal dose of dust was insufficient to ensure complete disinfection.* It is satisfactory to record that the type showed a much greater capability of recovery after attack than would be expected from Sakel.

(ii) *American Types.*

(*a*) At Bauga, a Government Pumping Scheme in Berber Province, XA1129 was sown on a 15-feddan Roguing Plot. The soil was good and the season favourable and a good yield of 5·87 large kantars of seed cotton per feddan was obtained. The general average of the station (which included both good and bad land, sown with a Webber type) was under 4 kantars per feddan. XA1129 appears able to do well in the absence of insect pests and on good land ; it is questionable whether, in the same season on the same land, any other type would have given the large yield obtained.

(*b*) At Shendi, on the Experimental Farm of the Gandeto Pump Scheme, Nucleus Roguing Plots were grown. Pink bollworm took its toll, but a good yield (5·7 kantars per feddan) was obtained from "513" (an early-maturing type orginally selected in India). A Uganda S.G.85 type ("511") gave 2·7 kantars per feddan and "514" (a selected type from Pump Scheme Strain) gave 4·6 kantars per feddan. The latter type is late maturing and pink bollworm destroyed the later bolls.

C. *Field Tests on Cotton.*

(i) *Egyptian Types.*

(*a*) *" Line Test " at Shambat.*†

Twenty-two types were tested, some for the first time.

Five were tested against X1530 as well as G.M.C. and three against X1530 only. The remainder were tested against G.M.C.

The following table shows the more important results.

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*The 1934/35 experience points to the cause being constitutional.

†See Report of E.C.G.C. Second Conference on Cotton-growing Problems, p. 51, for a note on the details of " Line Tests."

The yield of the variety row is expressed as a percentage of the mean yield of the two control rows :—

Type.	*Control Type* X.1530.	*Control Type* G.M.C.
NT2/33 (Gash Sakel)	132%	134%
NT3/33	144%	196%
NT4/33	121%	—
NT5/33 (Afifi × Sea Island Hybrid)	—	149%
508A	144%	188%
X730	—	148%
X04729	—	123%
X1530	115%	121%
G.M.C. Sakel	78%	93%

It will be noted that X1530, tested against two control rows of X1530, gave an increase of 15%, instead of showing reasonable equality.

A check made on the spacing of ridges showed that the spacing was not absolutely uniform, and in this case as in certain others, some of the increase could be ascribed to more favourable conditions of spacing for the " variety " ridge.

(*b*) *Preliminary Varietal Test.*

This experiment was carried out at the Gezira Research Farm, Wad Medani, in co-operation with the Plant Observation Section of the Gezira Agricultural Research Service. There were seven new strains (replicated five times) tested against G.M.C. at two sowing dates.

White ants and wilt caused heavy losses of plants, particularly in the later sowing, and two replications of the second sowing had to be discarded completely. The stand in the other beds was also very irregular, the loss being estimated at 40% in some beds. In spite of attempts at " equalization " at picking time, the reliability of the results can only be very low. Blackarm also was severe in some of the beds, and the late continuation of the rains caused very heavy defoliation. Leaf-curl became fairly general in the G.M.C. beds, but was negligible in the others.

X1530 and X1730 types seemed to be least affected by wilt, and the yields of these types, compared with other types, were outstanding in spite of the large margin of error.

(*c*) *Three Factor Experiment.*

This was also carried out at the Gezira Research Farm, and consisted of four types (X1530, X1530A, X04729 and X730) tested against G.M.C., with five replications at two sowing dates, and with and without ammonium sulphate manure.

As in the previous experiment, white ants and wilt caused severe losses in stand (estimated up to 50% in some beds) ; blackarm also attacked some of the plots badly and the figures obtained cannot be

considered as reliable. The calculated yields per feddan for the first sowing, however, ran in the same order as those in the varietal test at Barakat, and provided, therefore, a useful confirmation of the result of that experiment. X1530A seemed earlier in cropping than X1530. Leaf-curl was fairly general in the second growth of the G.M.C. beds, but negligible in the other types.

(*d*) *Barakat Varietal Test.*

This was grown on the Seed Farm at Barakat, by courtesy of the Sudan Plantations Syndicate.

There were five types tested against G.M.C., with five replications arranged in randomized blocks, at one sowing date. Single plots of two other types were grown as " belt " beds. I am indebted to Mr. J. M. Craig, V.C., for a report on the plot, which has been used in the following notes.

Germination was good, and the later stand fairly regular. Blackarm appeared on October 6th but only the X1530 strips were seriously affected. The second growth of the G.M.C. showed a high percentage of leaf-curl and some leaf-curl was found in other varieties. X04729 was a robust type, and looked the best in the early stages, but as the season advanced, the X1530 strains made rapid progress. The X1530A gave larger early pickings than X1530, and seemed earlier in growth.

In the final result, X1530 and X1530A gave significantly better yields than X04729 and X730, and these two latter gave significantly better yields than G.M.C. and X1030. The belt bed of Lecrem was on poor soil and the figure for yield cannot be used comparatively. The extent to which the soil affected yield can be judged from the fact that the adjacent bed of X1530 yielded at the rate of 3·25 kantars per feddan only. The results are tabulated in the appendix.

(*e*) *Comparative Inspection Plots in the Gezira Area.*

Five of these plots were grown, four adjacent to the Gezira Research Farm " Outstation " areas, and one, by courtesy of the Manager of the Kassala Cotton Company, at Wad Shair, in that Company's area.

Three varieties (X1530, X04729 and X1030) were sown in small plots between two similar plots of G.M.C.

At Wad Shair and Kab El Gidad, the X04729 seemed to thrive better than the X1530, and gave larger comparative yields, but at the other three stations (in Um Degarsi, Wad Hussein and Hag Abdulla blocks), X1530 was a comparatively better yielder. X1030 did better than G.M.C. at all places except Hag Abdulla. Both X1530 and X04729 retained their marked superiority to Sakel over a wide range of climatic and soil conditions.

(*f*) *Inspection Plots.*

(i) A new introduction from Egypt called " Nazli " was tried at Shambat and the Gezira Research Farm, but did not seem likely to be suitable for Sudan conditions. The plants did not look healthy, with slender rather straggly stems, short, sharply ascending sympodia and no monopodia. One feddan at Shambat yielded 1·18 kantars per feddan.

(ii) A small plot of " 508 " was grown at the G.R.F. and gave an impression of fruitfulness, though the bolls did not open very well.

(iii) A " selection pool," from natural seed of an F_1 between Ishan × Sea Island, was grown, and appeared very vigorous. Several plants were selected from among the more vigorous (bearing in mind the possibility that the vigour was merely " hybrid vigour ").

(ii) *American Types.*

(*a*) *" Line Test " at Shambat.*

This test was sown nearly three weeks earlier than the breeding plots. Growth was naturally better and the jassid attack seemed to have less serious results. XA1129 was used as the control type.

Eleven varieties were tested. Type "513" (an early strain from India) and types "514" and "514A" (a sub-strain of Pump Scheme Strain) gave considerably increased yields over the control. Pump Scheme Strain itself did not give so great an increase as the above. One Uganda type (511A) equalled the control, a result which must be considered satisfactory, as previous experience of Uganda strains at Shambat shows that they do not make the same response to the environmental conditions under irrigation as in rain-grown areas.

(*b*) *Standard Varietal Tests in the Nuba Mountains.*

Two experiments, one at Kadugli, and one at Talodi were carried out.

Tabular statements of the varieties tested and the results will be found in the appendix. The experiments were reported on by Mr. R. L. Knight, and at neither place were diseases or pests really serious. The stands were good, and the results should be reliable.

At Kadugli XA129 was significantly better than all other varieties, except XA02629 and XA1129. At Talodi XA129 gave the highest yields of lint per feddan, but this increase was not statistically significant except when compared with XA02629, which gave the lowest yield per feddan.

At Kadugli the yield of " 513 " in a belt bed was striking, but this result must be accepted with caution ; the belt bed of this type at Talodi also gave a good yield, but was not the best yielding bed in the plot, as it was at Kadugli. It was recorded that this type stood dry spells better than the other types.

(*c*) *Standard Varietal Tests in Mongalla Province.*

Two similar experiments—one at Kirrippi and one at Opari—were carried out. The results are given in the Appendix. These were reported on by Mr. H. E. King. The Kirrippi plot was regular and rather better grown than the Opari plot. The stands were good at Opari and patchy in places at Kirrippi. Diseases and pests were unimportant, except for elephant damage at Kirrippi, which affected three of the beds.

At both places XA129 (a selection from Pump Scheme Strain) gave a significantly better yield than Pump Scheme Strain, but not than Uganda S.G.29. At Opari this latter type also gave a significantly better yield than Pump Scheme Strain. XA1129 gave the lowest yield at both places.

(*d*) *Standard Varietal Test, Berber Province.*

This was grown on the Forage Farm on the Gandeto Pump Scheme at Shendi. (The results are tabulated in the Appendix.)

XA1129 and Pump Scheme Strain were significantly better than Zeidab Webber. The yields obtained from the plot were reasonably good ; pink bollworm was reported to be less than in the previous years, and though a fairly heavy infection on the plot was reported in the early stages, the attack diminished later.

(*e*) *Replicated Strip Test, Dongola Province.*

Ten repetitions of XA1129 and Pump Scheme Strain were tested against one another. The *lint* yields per feddan (taking all the beds) were 5·43 kantars per feddan for XA1129 and 5·29 kantars per feddan for Pump Scheme Strain.

The first three beds (which included two XA1129 beds) received a severe check in the early stages. The omission of the first two pairs of beds in the calculations does not, however, produce a significant difference in favour of XA1129. Nevertheless, a better price should be obtained for XA1129 lint, making it a more profitable cotton to grow.

(*f*) *Inspection Plots at Talodi, Kadugli, Opari, Kirrippi and Kagelu.*

Small plots of Acclimatized Uganda S.G.29 (obtained from Kadugli), and " 511 " (a selection from Uganda S.G.85) were grown at all places except Kagelu.

In Mongalla both types seemed promising ; at Kadugli the former seemed better than at Talodi, while " 511 " did better at Talodi than at Kadugli.

At Kagelu (Mongalla Province) a plot of XA129 was grown. The plants were erect, and in general well grown. The yield was 483 rottles seed cotton per feddan, calculated from an area of 1/7th feddan.

A number of short "inspection lines" of new types were also grown at Kagelu to test their suitability for that district, but no definite conclusions can yet be drawn.

D. *Valuations and Spinning Tests.*

As in past years, all samples were valued and graded through the courtesy of Messrs. Wolstenholme and Holland to whom continued thanks are tendered. The spinning tests on Egyptian types were duplicated at the Experimental Department of the Fine Spinners' and Doublers' Association, and at the Shirley Institute. Developments at the Shirley Institute now enable them to undertake the spinning of both American and Egyptian-type cottons, and as it is considered desirable to concentrate all growers' tests at one place, the Fine Spinners' Association have decided to discontinue testing these samples. This year's duplication of tests ensures continuity in the results.

This opportunity may be taken of thanking the Fine Spinners' and Doublers' Association for their most valuable help over many years, and expressing regret at the severance of the official connection. Thanks are equally due to the B.C.I.R.A. for their willingness and ability to test the Egyptian types as well as the American types.

(i) *Egyptian Types.*

In both sets of tests, Lecrem and NT2/33, two Sakel types which had not been previously tested, showed greatest merit, while "508" was considered the poorest sample. The comparisons between G.M.C. and X1530 in the different experiments were interesting. At Barakat the X1530 gave slightly better results than the G.M.C. In the Three-Factor Experiment at Wad Medani, G.M.C. was appreciably better than the X1530, while in the Preliminary Varietal Test, X1530 was considered superior to G.M.C.

These tests confirm in this particular comparison, the experience of previous years' tests, and it is safe to assert that over a series of years, the difference in spinning value of strictly comparable samples, would be negligible. Previous experiments show that from year to year far bigger differences in spinning value are obtained in G.M.C. grown in the same locality, than obtained in any one year between X1530 and Sakel. These tests were all carried out at 100's counts. At higher counts, the evidence of this year's tests indicates that Sakel would be superior.

(ii) *American Types.*

All the samples were spun to 50's and 64's. Eight samples were spun to 80's.

XA1129 at Shendi, Kadugli and Kirrippi, and "514" at Shendi and Kadugli, gave the strongest yarns in 50's, 64's and 80's.

Zeidab Webber was better than Pump Scheme Strain at Shendi in 50's counts, while "513" was equal to it. At Kadugli "513" was not equal to Pump Scheme Strain.

The Pump Scheme Strain yarns, as usual, came high in order of appearance, followed by XA1129.

Locality appears to have made less difference than usual, though the two samples from Shambat gave the highest blowroom loss and were the neppiest.

Taking into consideration strength and appearance, the best yarns were obtained from XA1129 and "514". "513" was considered to be the poorest sample, as it was slightly weaker than Pump Scheme Strain in Kadugli and about equal to it at Shendi, with on the whole a slightly inferior appearance.

E. *Other Experiments and Observations.*

These include the usual "Observation Plot" on which regular routine records are made for comparison with previous years.

A "Drum Experiment" with single plants growing in different types of soil was carried out, parallel to a similar experiment at the Gezira Research Farm. The growth of the plants differed considerably from the growth at Medani, and approximated to the type of growth in the Northern areas of the Gezira. "Rootwashing" was done at regular intervals during the season on Sakel, X1530, X04729 and XH1229. Root diagrams were plotted to scale and retained for comparison with similar diagrams to be made in subsequent seasons.

Appendix.

Tables of Yields from Varietal Tests, 1933/34 Season.

I. *Egyptian Types.*

(*a*) At Barakat.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
X1530A	5·12	5·15	31·9
X1530	5·03	5·08	32·1
X04729	4·13	3·82	29·3
X730	3·92	3·94	31·9
X1030	2·83	2·59	29·1
G.M.C.	3·04	2·86	29·9
X1030B (Belt)	2·51	2·11	26·7
Lecrem (Belt)	2·68	2·37	28·1

X1530 A is significantly better than X730, X04729, G.M.C. and X1030.
X1530 " " " X730, X04729, G.M.C. and X1030.
X730 " " " G.M.C. and X1030.
X04729 " " " G.M.C. and X1030.

II. *American Types.*

(*a*) At Kadugli.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
XA02629	6·17	5·71	29·4
XA1129	5·80	5·44	29·8
XA2030	5·52	5·29	30·4
XA129	6·14	6·00	31·0
Pump Scheme Strain	5·25	4·89	29·6
Accl. Ug. S.G.29	5·28	4·76	28·6
513 (Belt)	7·91	7·38	29·6
514 (Belt)	5·40	5·34	31·4

XA129 is significantly better than XA2030, P.S.S. and Accl. Ug. S.G.29.
XA02629 „ „ „ P.S.S. and Accl. Ug. S.G.29.
XA1129 „ „ „ Accl. Ug. S.G.29.

(*b*) At Talodi.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
XA02629	4·98	4·84	30·8
XA1129	5·40	5·22	30·7
Pump Scheme Strain	5·72	5·36	29·7
XA129	5·62	5·65	31·9
XA2030	5·39	5·27	31·0
513 (Belt)	6·23	5·95	30·3
514 (Belt)	4·52	4·40	30·8

XA129 is significantly better than XA02629.

(*c*) At Kirrippi.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
XA1129	1·88	1·78	30·1
XA2030	2·13	1·98	29·5
Pump Scheme Strain	2·49	2·28	29·1
Ug. S.G.29	2·69	2·45	28·9
XA129	2·81	2·77	31'3
513 (Belt)	2·73	2·63	30·6
514 (Belt)	2·91	2·83	30·9

XA129 is significantly better than P.S.S., XA2030 and XA1129.
Ug. S.G.29 „ „ „ XA2030 and XA1129.
P.S.S. „ „ „ XA1129.

(*d*) At Opari.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
XA1129	2·18	2·12	30·7
XA2030	2·48	2·45	31·3
Pump Scheme Strain	2·41	2·26	29·7
Ug. S.G.29	2·74	2·73	31·6
XA129	2·73	2·82	32·7
513 (Belt)	2·78	2·82	32·2
514 (Belt)	2·40	2·36	31·2

XA129 is significantly better than XA2030, P.S.S. and XA1129.
Ug. S.G.29 „ „ „ P.S.S. and XA1129.
XA2030 „ „ „ XA1129.

(*e*) At Shendi.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
XA1129	5·48	5·03	29·1
Pump Scheme Strain	5·97	4·84	25·7
XA129	4·87	4·36	28·4
XA02629...	3·97	3·36	26·9
Zeidab Delta Webber	4·01	3·49	27·6
513 (Belt)	6·34	5·49	27·5
514 (Belt)	3·41	2·84	26·4

XA1129 is significantly better than XA129, Zeidab Webber and XA02629.
P.S.S. „ „ „ XA129, Zeidab Webber and XA02629.
XA129 „ „ „ Zeidab Webber and XA02629.

(*f*) At Nuri.

Variety.	*Seed cotton in large kantars per feddan.*	*Lint in small kantars per feddan.*	*G.O.T. %.*
		On 20 Beds.	
XA1129	5·56	5·43	31·0
P.S.S.	5·94	5·29	28·3
		On 16 Beds.	
XA1129	6·00	5·86	31·0
P.S.S.	6·12	5·46	28·3

The differences are not significant.

(Included by courtesy of the Uganda Government.)

UGANDA

COTTON EXPERIMENT STATIONS, BUKALASA AND SERERE. PROGRESS REPORTS FOR THE SEASON 1933-34

Bukalasa Zone.

BY

G. W. NYE.

Meteorology.

The season under review was definitely a dry one, the total deviation from the 11-year average being a deficiency of 8·69 inches. May, June and July were abnormally dry and as a consequence cotton planting was seriously held up. Hand watering had to be resorted to on the cotton breeding plot. September was very wet and as a result Angular Leaf Spot spread rapidly. Fortunately, the succeeding months were dry and the disease received a severe check, doing comparatively slight damage. The period from December to March was intensely dry and the result was a very rapid ripening of the cotton crop with a suppression of new growth and of the second flowering peak. Many of the later bolls opened prematurely and a high proportion of immature lint was harvested at that particular period. No second picking peak occurred.

Hail fell on three occasions and did considerable damage to the tobacco plots ; cotton was also damaged, but being young it was able to make a remarkable recovery. It is interesting to note that one plot of the subsidiary cotton variety trial was struck by lightning, about 20 plants being killed.

As far as Bukalasa was concerned, the season was definitely favourable to cotton and higher yields were obtained than in the previous season. The dry and hot weather constituted a check to the spread of disease and of insect pests. It produced cotton which was rather shorter in staple than last season, but the percentage of stained seed cotton was very low indeed and the general grade was excellent.

The following table summarises the more important meteorological records of the season :—

TABLE I.

METEOROLOGICAL SUMMARY.

Month.	*Rainfall.*	*Deviation from 11-year mean.*	*Daily Hours Sunshine.*	*Remarks.*
1933 :—				
April	6·79	−0·08	Unreliable	Unusually dry. 3·27 ins. fell on 30th.
May	3·12	−1·78	4·9	Very dry from 15th onwards.
June	2·83	−0·76	4·8	Very dry. Early planting held up.
July	2·46	−1·31	5·0	No rain from 1st to 16th. Cotton planting delayed. Breeding plot hand watered. Hail on 27th.
August	6·57	1·88	5·4	Dry until middle of month. Good rains later.
September ...	7·44	2·35	5·4	Record total rain for September. Hail on 5th. Excellent weather for growth.
October	4·75	−2·40	5·6	Rains of September encouraged Angular Leaf Spot. Lowest total rains were recorded for October. Hail on 8th.
November ...	2·10	−2·22	5·7	Very dry. Good check to A.L.S. and Blackarm.
December... ...	4·11	1·10	6·1	No rain after 18th. Check to disease.
1934 :—				
January	0·54	−1·13	6·5	Very dry. Rapid ripening.
February	0·41	−1·90	6·9	Very dry. Premature opening. Check to second peak.
March	2·37	−2·44	6·2	
TOTAL	43·49	−8·69	...	

COTTON.

BREEDING PLOT.

New Selections. Over eighty single rows were planted early in July, consisting of about thirty entirely new selections, the remainder being made up of re-selections from the previous year. Among the new families no very promising material was obtained, in fact, out of the thirty only two are being retained, one for drought resistance and the other for yield.

Re-selections from the B.31 group continued to show very high resistance to Angular Leaf Spot and to early Blackarm, but they appeared to be very susceptible to Fusarium Wilt which occurred in the breeding plot for the first time to a really serious extent.

The most promising group was a number of new selections from B.37 families—plants in this group have nice erect habits and excellent lint, the average staple being 32 mm. They are not very resistant to Blackarm, but at the same time appear able to tolerate it and to produce a good yield.

The early maturing B.45 group did well, and although the lint is on the short side it is of quite good quality.

U.4 derivatives were again disappointing and the only one worth proceeding with is U.4/B/12/5, a selection from the South Rhodesian U.4/130.

Single plant selections were made in Native plots in the villages, a prize being given to the owner of the plant which had the greatest number of harvested bolls. The winning number was 232.

Pedigree Lines.—A total of 28 lines was grown, several of which showed considerable promise. Those of the U.4 group were again disappointing and although the plant habits were excellent and rate of flowering high the yields were mediocre and the lint poor. Of the lines of the B.31 group B.P. 45/33 was the most promising but its resistance to Blackarm was not as high as the others, B.P. 46/33 being better in this respect. The two B.37 lines did well although heavily infected with Blackarm. B.P.50/33 was particularly promising as regards habit and yield, and its proportion of sound to total locks was the highest recorded. In addition, its lint length and ginning percentage were very satisfactory.

A re-selection from S.G.23/8, B.P.58/33, was distinctly promising as regards yield and appeared to be less susceptible to Blackarm than the original parent. It was rather late maturing but gave the highest yield of any of the pedigree lines. It also gave the lowest rate of boll shedding, thus inheriting this character from its ancestor. Its ginning out-turn is very good, but the lint length is rather on the short side.

B.P.59/33 is a brother of B.P.58/33, but was quite different in several characters—its shedding rate was higher and its proportion of sound to total locks was the lowest of all the lines. On the other hand, its staple was longer and ginning out-turn lower than B.P.58/33.

In the U.4 group B.P.63/33 is noticeable for its high rate of flowering coupled with a high rate of shedding ; its lint is short and harsh. S.P.48 yielded very well and gave a low rate of boll shedding ; in addition it showed resistance to Angular Leaf Spot and Blackarm, and had the excellent U.4 habit—its lint, however, was much below standard.

S.P.72 from Serere showed high resistance to Blackarm, but was very late maturing and not very high yielding.

The two best lines, B.P.50 and B.P.58, will be increased next season and included in the variety trial.

The following tables summarise the quantitative characters of the most promising pedigrees :—

TABLE II.

Pedigree.	*Mean flowers per plant.*	*Mean bolls per plant.*	*Shedding percentage.*	*Total sound locks per plant.*	*Percentage sound locks to total locks.*
B.P.46/33	65·0	20·4	68·5	67·2	78·8
B.P.50/33	76·3	24·8	68·1	67·9	89·0
B.P.52/33	74·3	25·5	65·6	78·3	76·5
B.P.58/33	66·5	29·7	53·2	100·0	83·5
B.P.59/33	65·6	24·6	62·5	48·4	47·5
B.P.63/33	100·1	25·7	74·3	78·1	70·5
B.P.68/33	68·4	20·3	70·3	63·8	75·1
S.P.48	68·8	27·9	59·5	93·0	78·0
S.P.72	62·0	22·6	63·4	73·9	80·6

TABLE III.

Pedigree.	*Loculus No.*	*Weight seed cotton per boll. grams.*	*G.O.T.*	*Lint length. mm.*	*Origin.*
B.P.46/33	4·16	4·86	29·8	29·3	B.31
B.P.50/33	3·98	5·05	31·4	31·9	B.37
B.P.52/33	4·02	4·72	32·2	31·0	B.42
B.P.58/33	4·04	5·00	32·6	29·4	S.G.23/8
B.P.59/33	4·14	5·53	27·7	30·5	S.G.23/8
B.P.63/33	4·35	4·65	34·4	27·8	U.4/4/2
B.P.68/33	4·16	5·18	...	...	U.4/4/2
S.P.48	4·26	4·94	36·8	28·3	U.4/4/2
S.P.72	4·03	4·55	...	...	N.17. Nariama.

Purity targets show the variation in purity of the three Pedigree Lines.—B.P.52/33 shows up as being very uniform indeed for both lint length and gunning out-turn while B.P.58/33, although in its 8th generation, is very irregular for both characters, but more especially for ginning out-turn. B.P. 50/33 has quite a good target, but there are about four obvious off type plants.

Reference Plot.

A collection of imported varieties, etc., including Delrect, Webber, Meade, Acala, Cambodia, Bancroft, Wildes, and Ishan was maintained. Ishan yielded very heavily and was comparatively free from disease. The habit of the plant was excellent, but the lint was rather short and very harsh. None of the other varieties showed any promise.

New Introductions.

A number of crosses made by Dr. Harland were received from The Empire Cotton Growing Corporation for trial. Considerable variation existed, but several promising types were selected for further trial. Examination of the results of these has not yet been completed.

Increase Plots.

(*a*) *Small Bulk.*—Two plots of S.G.23/8 were grown to provide a supply of seed for next year's main increase plot. One of the plots was used for detailed individual plant records. A large number of data have been obtained and will be analysed as the opportunity occurs.

The yield from the second plot was at the rate of 706 lbs. per acre.

(*b*) *Medium Bulk.*—An acre plot was planted with B.P.38/32, a U.4 derivative which had yielded very well in the previous season's Pedigree Lines. The plot was divided into two, one half being sprayed with a tobacco soap spray and the other with water, to ascertain if there was any effect on Lygus. No effect was observed and the final yields of the two portions of the plot were practically identical. The plot yielded at the rate of 619 lbs. per acre.

Variety Trial (Bukalasa).

The following eight varieties were grown in an 8 by 8 Latin square :

Local (Bukalasa).
Local (Nakisunga).
S.G.23/8 (low shedder and good spinning qualities).
S.G.29.
B.31 (bulked—resistant to Blackarm).
B.P.28/32 (B.42 group, early maturing).
B.P.38/32 (a U.4/4/2 derivative).
B.16.

The object of including Nakisunga Local was to ascertain whether there were any noticeable differences between " Locals " from different areas. The only difference observed was that the Nakisunga Local was far more variable as regards plant type than Bukalasa Local.

Planting took place in July and no varietal differences in germination were observed. Weekly counts of Angular Leaf Spot, Blackarm, Lygus, and Helopeltis infection were made throughout the season. B.31 retained its marked resistance to Angular Leaf Spot and Blackarm while the next in order of resistance was B.P.38/32. The two Locals were comparatively slightly attacked while the other varieties were more susceptible, although the effect of the disease was not severe and was not correlated in any way with the final yields.

The following table gives a summary of the observations made on November 8th :—

TABLE IV.

Variety.	*% plants infected Angular Leaf Spot.*	*% plants infected Blackarm.*
B.31	35	8·2
Local (Nakisunga)	84	34·4
B.P.38/32	84	38·6
Local (Bukalasa)	80	36·4
B.16	92	42·8
S.G.29	96	49·4
S.G.23/8	93	54·2
B.P.28/32	95	63·6

The Lygus and Helopeltis counts did not give much information, except that there was an indication that B.P.38/32 and S.G.23/8 had slightly less severe Lygus damage than the other varieties.

With regard to plant habit, B.P.38/32 was outstandingly better than the others. S.G.29 and B.16 were particularly bad, the plants being badly " lodged " by the beginning of the picking season.

Picking curves were very similar, except that of B.P.28/32 which is a distinctly early maturing type and of S.G.23/8, which is rather late in maturing. The curves were single peaked owing to the abnormally dry weather.

The grade was excellent and the percentage of stained cotton very low. The staple was somewhat shorter than last year's, Local

and S.G.23/8 being approximately 1 mm. less. The following table is a summary of the results :—

TABLE V.

Variety.	*Mean wt. seed cotton per plot. lbs.*	*Percentage stained cotton.*	*Ginning Out-turn.*	*Meant wt. Lint per plot lbs.*	*Yield per acre seed cotton lbs.*	*Lint length mm.*	*Lint Index.*
S.G.23/8	45·0	7·8	33·8	15·1	1,801	28·9	5·6
Local (Bukalasa) ...	44·1	8·7	29·7	13·1	1,764	28·6	4·7
Local (Nakisunga)	43·6	8·5	29·0	12·6	1,743	...	...
B.P.28/32	34·5	13·5	30·8	10·5	1,379	30·2	5·2
S.G.29	34·9	11·8	28·4	10·0	1,395	29·6	6·0
B.16	35·2	10·3	28·6	9·8	1,409	...	...
B.31	33·7	8·8	27·8	9·3	1,349	30·3	4·9
B.P.38/32	28·9	19·3	32·8	9·2	1,131	...	...
Mean	37·3	11·1	30·1	11·2	1,495	...	...
S.E. Difference ...	1·58	0·81	...	0·96	63·2	...	...
Significant Difference ...	3·16	1·62	...	1·92	126·4	...	...

Discussion of Results.

(*a*) *Seed Cotton.*—The results are significant when P=0·01 and show S.G.23/8 and the two Locals to give similar yields and significantly higher yields than any of the other varieties. This result is similar to that obtained last season. There are no differences between the other varieties except that all are significantly better yielders than B.P.38/32.

(*b*) *Percentage of Stained Seed Cotton.*—The results follow closely those of last year and are highly significant. All varieties have less stained seed cotton than B.P.38/32. There is no difference between S.G.23/8, the Locals, and B.31, and these four are significantly better than the other varieties in this respect. B.16 has significantly less than S.G.29 and B.P.28/32, while S.G.29 has less than B.P.28/32. The percentage of stained seed cotton is much lower than last year, the average being 11·1 as against 17·1. The very high proportion in B.P.38/32 is noteworthy. The U.4 types appear to have a definitely high percentage under Uganda conditions.

(*c*) *Ginning Out-turns.*—These were done on bulk samples with a 12-inch gin. Both S.G.23/8 and B.P.38/32 have very satisfactory ginning percentages, while B.31 is disappointingly low.

(*d*) *Lint Yields.*—These results are significant when P=0·01. S.G.23/8 gives a significantly higher yield of lint than any other variety. The two Locals come next and give higher yields than the remaining varieties between which there are no differences.

(*e*) *Summary.*—The general results are satisfactory. S.G.23/8, which is still far and away the best spinning cotton, has held its own

with Local and actually gave a higher yield of lint. B.31 was disappointing except that its resistance to Blackarm was definitely confirmed, and further selection may produce a higher yielding type. B.P.28/32 was interesting on account of its early maturing character. B.P.38/32 was definitely bad—it exhibited characters typical of U.4 under these conditions—excellent habit, very heavy flowering, high rate of boll shedding, much shrivelling of bolls, a high percentage of stained cotton, high ginning out-turn and harsh lint. Neither B.16 or S.G.29 are worth further trials under Buganda conditions.

Outside Variety Trials.

Variety trials to compare S.G.23/8 with Local were conducted at the following centres :—

Mengo.	Kalagala.
	Makurubita.
	Nakisunga.
	Nakifuma.
Entebbe.	Kabasanda.
	Nkozi.

The following table summarises the results :—

TABLE VI.—Yields in lbs. per 1/40th-acre Plot.

Centre.	*Local.*		*S.G.23/8.*		*Mean yield per acre lbs.*
	Seed cotton.	*Lint.*	*Seed cotton.*	*Lint.*	
Kalagala	28·9	8·0	22·5	6·8	1,028
Makurubita	28·6	9·6	24·4	8·4	1,060
Nakisunga	19·5	6·4	21·4	7·1	818
Nakifuma	26·9	8·3	26·4	8·8	1,066
Nkozi	34·8	12·0	35·1	12·1	1,398
Bukalasa	44·1	13·1	45·0	15·1	1,782
Mean	30·5	9·6	29·1	9·7	1,192

The indications are that there is no difference in yield between S.G.23/8 and Local, but S.G.23/8 appears to have a better ginning out-turn by 1—2 per cent. and is a much superior cotton from the spinning point of view. Comparing the results with those of last year, the relationship between the two varieties remains the same, but there is a distinct reduction in average yield at all centres except Bukalasa, where an increase of 650 lbs. is recorded. S.G.23/8 can be said to be a definite advance on Local from a spinning point of view, but as the yields are practically identical there would be no point in replacing Local with S.G.23/8 unless a high enough premium were paid for the lint to benefit the growers.

Spinning Tests and Brokers' Reports (1932/33 *Crop*).

The following reports were received from Messrs. Wolstenholme & Holland on a series of samples sent for spinning tests :—

TABLE VII.

Variety.	*Length of staple.*	*Strength.*	*Valuation (based on middling American 5·37 pence per lb.).*
S.G.23/8 (Bukalasa)	Good $1\frac{1}{8}$"	Medium ...	6·07
Local ,, ...	Full $1\frac{1}{8}$" irregular ...	Strong ...	6·37
S.G.23/8 (Nakifuma)	Full $1\frac{1}{8}$" irregular mixed with short	Medium ...	6·17
Local (Nakifuma)	$1\frac{3}{16}$"	Strong ...	6·37
S.G.23/8 (Mpigi)	$1\frac{3}{16}$"	Medium ...	6·27
Local ,, ...	$1\frac{3}{16}$"	Strong ...	6·47

These are interesting when considered in conjunction with the spinning test results given below as they again show the apparent inability of brokers in some instances to detect a good spinning cotton. In these and all previous spinning tests, S.G.23/8 has proved distinctly superior to Local, especially in yarn strength. Here in each case Balls's paradox is borne out—S.G. 23/8 with its low hair weight per centimetre and the strong yarn is only classed by the brokers as "medium strength" and in each case loses points for this.

The following table summarises the Spinning Test results :—

TABLE VIII.

Sample.	*Actual Count.*	*Lea Strength lbs.*	*Count × Strength.*	*Count × Work of Rupture.*	*Highest Standard Count.*
50's					
Bukalasa.—					
S.G.23/8	49·3	50·0	2,465	2,875	70–75
Local	48·7	38·8	1,890	2,401	40–44
Nakifuma.—					
S.G.23/8	49·0	50·1	2,455	2,901	73–77
Local	50·0	39·8	1,990	2,345	48–52
Mpigi.—					
S.G.23/8	50·5	43·2	2,182	2,698	58–62
Local	49·0	40·1	1,965	2,489	44–48
64's					
Bukalasa.—					
S.G.23/8	63·4	34·4	2,181	2,620	...
Local	63·2	25·9	1,637	2,038	...
Mpigi.—					
S.G.23/8	63·3	27·3	1,865	2,116	...
Local	63·9	26·5	1,693	2,356	...
80's					
Nakifuma.—					
S.G.23/8	79·1	24·1	1,906	2,195	...
Local	77·8	19·7	1,533	1,989	...
Mpigi.—					
S.G.23/8	81·7	20·3	1,659	2,047	...
Local	73·9	21·0	1,552	2,010	...

It will be seen that S.G. 23/8 is definitely superior to Local except at Mpigi where there is very little difference. The report states, *inter alia :*

"... in all three localities S.G.23/8 has a lower hair weight per centimetre than Local. Samples of S.G.23/8 and Local have higher hair weights per centimetre than the corresponding samples tested last season." ... "In strength S.G.23/8 is by far the best in all three localities, but its superiority is less marked at Mpigi than at Nakifuma and Bukalasa."

A further series of samples was tested at the Technological Laboratory of the Indian Central Cotton Committee. The results are summarised below :—

TABLE IX.

Variety.	*Points on (Basis 200 Rs.)*	*Mean Fibre Length.*	*Fibre weight per inch (millionth of an ounce).*	*Highest standard warp counts.*	*Strength × Count.*		
					30's	40's	50's
Bukalasa.—							
S.G.23/8 ...	135	1·06	0·107	65	2,388	2,141	2,026
Local ...	120	1·01	0·141	46	1,965	1,720	1,593
Nkozi.—							
S.G.23/8 ...	125	1·05	0·113	55	2,227	1,982	1,816
Local ...	115	1·04	0·133	45	1,877	1.692	1,565

" Of the eight cottons, S.G.23/8 grown at Bukalasa has given the best spinning performance while the same cotton grown at Nkozi is much inferior in its performance . . . the performance of the two Local cottons is markedly inferior to that of S.G.23/8."

This season's results confirm those of previous years in demonstrating the definite superiority of S.G.23/8 over Local Buganda from a spinning point of view.

Thanks are due to the Indian Central Cotton Committee, the Empire Cotton Growing Corporation, The British Cotton Industry Research Association, and to Messrs. Wolstenholme and Holland, for so kindly arranging for and carrying out the examination and tests of these samples.

Diseases and Insect Pests.

As usual, Angular Leaf Spot and Blackarm were present, but their incidence was not severe on account of the dry weather. Observations on resistance and susceptibility were continued. B.31 continued to show resistance, but became heavily infected with what might be called a secondary Blackarm attack at the end of the season. The B.37 group appeared susceptible, but produced an excellent crop all the same ; it is possible that this group, although not resistant to infection, may be resistant to the effects of the disease.

The only other serious disease was Wilt which has definitely spread at Bukalasa and in Buganda generally in the last two years. At least 100 infected plants occurred on the Plantation ; these were uprooted and burnt as soon as they appeared to be suffering from the disease. Several families of B.31 appeared to be very susceptible to it. Work on resistance is being taken in hand at once.

Insect pests were very much less in evidence than in the previous season. Lygus did a certain amount of damage. Helopeltis was only observed on a May-sown plot of S.G.23/8, and an adjacent plot of the same variety planted in July was practically free from this pest. It is interesting to note that this plot was the only one on the whole plantation which was attacked by *Dysdercus* spp. Hand

picking as a means of reducing the infection gave satisfactory results. Actually, the attack did not occur until March when most of the crop had been harvested.

Bollworms were present as usual. No pink bollworm has yet been found on or near the Plantation.

Jassids were expected in the dry weather, but they were never present in vast numbers and the susceptible S.G.23/8 showed no signs of damage.

Syagrus did a great deal of damage on old land. No plants were attacked on new or practically new plots.

Cotton Increase in Buganda.

The question of a seed farm and its attendant stages for Buganda is still engaging attention, and the possibilities of the Entebbe Peninsular as a seed farm stage are being fully explored. A Main Bulk Area is now available at Bukalasa where the segregated $\frac{1}{4}$ acre, 1-acre and 18-acre increase plots are now arranged for. S.G.23/8 will be put into the main bulk stage next season.

Cultural Experiments.

(1) *Tractor cultivation versus Native hoeing*, combined with a test of 4 ft. by $1\frac{1}{2}$ ft. (Control) spacing, against 3 ft. by 1 ft.

No differences in yield were obtained between the methods of cultivation, but close spacing gave a significant increase over control.

(2) *Mulching Late Sown Cotton.*—This experiment was continued, and mulching again gave a significant increase in yield over control. The high cost of mulching (over 65/– per acre), however, more than counterbalanced the value of the increased yield, despite the fact that the cost of weeding was less.

TABLE X.

	Mean yield per plot. lbs.	*Mean yield per acre.*	*Value of crop per acre.*	
			Shs.	*Cts.*
Mulched	48·5	873	98	52
Control	40·6	371	80	42

(3) *Inter-planting and Spacing.*—This experiment was repeated on slightly modified lines, and apart from showing a significant decrease in yield due to wide spacing, no results were obtained. The widespread local practice of inter-planting in Buganda appears to have no deleterious effect on the cotton crop, provided planting is done at the proper time. On the contrary, the gross return per acre is greater with inter-planted cotton.

The question of a residual effect and possible hastening of soil exhaustion in the inter-planted plots will need to be considered, and it is hoped to start an investigation next season.

(4) *Manurial Experiment.*—A first trial was made of the effect of green manure and of cotton seed on the following cotton crop. Lay-out 4 by 4 Latin square with the following treatments :—

1. Control. 2. Cotton seed @ 5 tons per acre. 3. Green manure (*Crotalaria Juncea*). 4. Cotton seed @ $2\frac{1}{2}$ tons combined with green manure.

The results of the first season are very interesting, the effect of cotton seed being most marked while that of green manure was slight, if any. The outstanding effect of cotton seed was to hasten maturity considerably, and it is interesting in this connection to observe that in Treatment 4 the effect of green manure was to depress the early maturing effect of the cotton seed. The green manure plots matured later than any of the others. The results of the first year are tabulated below :—

TABLE XI.

Treatment.	*Yield per plot. lbs.*	*Yields as percentage of mean.*	*Percentage of Fifi.*	*Yield per acre.*
1	22·5	77·4	12·7	812
2	33·6	115·1	11·4	1,220
3	27·4	94·0	10·3	987
4	32·9	113·1	8·9	1,182
Mean	29·1	100·0	...	1050·2
S.E. Difference	3·02	10·4	...	...

Cotton seed gives a significant increase in yield over control, and green manure, cotton seed combined with green manure, gives a significant increase over control. This experiment is being carried on over a period of years ; the residual value of the manurial treatments will be tested with a crop of groundnuts in the spring of 1935.

Serere Zone.

BY

H. R. HOSKING AND J. D. JAMESON.

Meteorology.

Weather conditions, both at Serere and in the district, were undoubtedly good over the season as a whole. The result was an excellent cotton crop everywhere this side of the Nile.

The month of May was ideal for cotton planting, and early-planted cotton did well. June and July, however, were decidedly dry in some districts, and at Serere the rainfall was too irregular to be of much use. Consequently late cotton—unfortunately all too prevalent in the

district—became very late cotton indeed, much of it being planted in September. The situation was saved by rain in mid-December, which gave a stimulus to the late crop, although it stained some of the early cotton. Finally, an almost rainless buying season produced a crop beyond expectation in quantity, and in quality the best for many years.

Cotton.

Diseases and Pests.

Bacterium malvacearum.—Angular Leaf Spot and Blackarm counts are mentioned in the sections dealing with the Cotton Breeding Plot and the Variety Trials. The leaf-spot stage spread rapidly in May and June and again in September, but, as a dry spell followed on each occasion, blackarm lesions did not become a serious disease for the season.

Jassids.—The dry spells of October-November and January-February gave a stimulus to jassid activity. Jassids were present in sufficient numbers to make susceptible varieties apparent in the breeding plot, thus greatly assisting the task of selection. They undoubtedly influenced the crop in certain areas, but the damage was not serious.

Helopeltis bergrothi.—Numbers of these insects occurred in one field on account of a neighbouring crop of sweet potatoes. Corky scabs were noted on green bolls in November, and many plants were stunted. The pest did not assume serious proportions in any of the districts this year.

Lygus Vosseleri.—The attack of this insect was worse than usual at Serere, but the damage was not noticeable after the leaf-shedding that occurred during the dry spell in October and November.

Dysdercus spp.—Though not a serious pest, Cotton Stainers were comparatively plentiful at Serere. Migration to the Breeding Plot was observed on December 11th.

Platyedra gossypiella.—The pink bollworm was recorded east of the Nile in parts of the Northern Province. It was not recorded in the Eastern Province.

Earias spp. and Argyroploce spp. were present as usual at Serere, but not in abnormal quantity.

A Fusarium wilt disease attacking the roots of cotton was observed for the first time. It only occurred on varieties the seed of which had been imported from Bukalasa, and it is probable that the disease came from that source. All the Bukalasa strains, save one which was not affected, were uprooted and burnt, and the plot has now been put down to a permanent crop.

The Cotton Breeding Plot.

Pedigree Lines.—41 strains were planted as follows :—

27	U.4/4/2 derivatives numbered	S.P.39–65
8	Nariama derivatives numbered	S.P.66–73
5	Acala derivatives numbered	S.P.74–78
1	U.4. derivative from Southern Rhodesia numbered	S.P.79

The five Acala strains were all abandoned on account of susceptibility to jassid and poor habit.

New Selections.—81 new selections were planted as follows :—

Nyasaland Upland group.

2	S.G.29 derivatives numbered	S.48–49
9	Nariama derivatives numbered	S.50–58
9	re-selections derived from local selections made in previous years	S.63–64 S.78–84
16	local selections from the 1932–33 crop ...	S.85–100

Cambodia group.

4	re-selections numbered	S.59–62

Acala group.

13	re-selections numbered	S.65–77

*U.*4 group.

8	U.4 derivatives numbered	SU.33–40
19	U.4 (Southern Rhodesia) derivatives numbered	SU.41–59
1	U.4/4/2 derivative numbered	SU.60

The one remaining Bukalasa strain, BP.49, was also planted in this series, but it suffered very badly from Blackarm and Helopeltis. A large proportion of the above series were abandoned on account of Blackarm, jassid or bad habit, and only 42 were retained for analysis.

New Introductions.—34 hybrid strains received from Dr. Harland, Trinidad, were planted. The first series of nine, numbered by us X.12–20, did extremely well, and three of them, X.13, 14 and 17, had very good lint. The second series, of which 25 were tried out of a much larger number received, proved disappointing. After abandoning strains susceptible to Blackarm and jassid, only 14 remained for analysis.

General.—The final stand obtained was satisfactory, although watering was needed to secure germination. Slight hail in November did no appreciable damage and it was possible to make notes on habit all through the plot. In the absence of habit notes from the previous year these records were very enlightening.

Flowering and the first pick are the earliest on record. Flowering was very prolific, being about 40% more than last year. Rain in mid-December caused two picks to be badly rain-stained. Many of the early strains produced their peak pick in little over five months, and

their main crop was finished in less than seven. S.P.39 is the earliest strain, and in addition it has a very neat, small type of plant.

Diseases and Pests.—The Pedigree Lines were interplanted with rows of S.G.29 as a Blackarm index. In all cases the new strains had considerably less Blackarm than the rows of S.G.29. In a few instances seed from the most susceptible plant in the same strain was planted in place of the S.G.29 control. The object of this was to see whether selections breed true for resistance and susceptibility to Blackarm. It was found that they do, as in every case the Pedigree Line had fewer Blackarm lesions than the more susceptible relative.

The Nariama family is still resistant to Blackarm, but the lint length tends to be short, the yields are not satisfactory, and the strain appears to be very susceptible to jassid.

The U.4/4/2 family is still very resistant to Blackarm and jassid.

The Acala strains were all abandoned on account of susceptibility to jassid and poor habit.

Lint.—There was a very high proportion of immature cotton in all strains, and a most disconcerting variation in staple even on individual plants. The lint lengths obtained from the Pedigree Lines were most disappointing. Allowance must, however, be made for the fact that all cotton in the immediate district was short this season.

July 5th, the customary sowing date for the Breeding Plot at Serere, proved to be an unfortunate one this year. In consequence there were a large number of stunted plants in the breeding plot; these gave an insignificant yield, combined in almost every case with very poor lint.

The following tables summarise the characters of the leading strains :—

BIOLOGICAL CHARACTERS.

	Habit.	*Jassid.*	*Blackarm lesions per plant.*	*Flowers per plant.*	*Shedding %*	*Date of*	
						1st flower.	*Peak pick.*
S.P.39 ...	Excellent : small ...	nil	0·05	55	61	Sept. 4th	Dec. 19th
S.P.40 ...	Good	nil	0·14	58	66	Sept. 4th	Dec. 27th
S.P.43 ...	Good : rather large	nil	0·04	61	63	Sept. 7th	Dec. 27th
S.P.48 ...	Good	nil	0·10	66	74	Sept. 6th	Dec. 27th
S.P.56 ...	Fair : large : not quite straight ...	×	0·04	50	63	Sept. 6th	Jan. 9th
S.P.57 ...	Fair : irregular ...	×	0·09	46	63	Sept. 6th	Jan. 16th
S.P.72 ...	Poor : straggly ...	×××	0·10	44	61	Sept. 8th	Jan. 9th

BOLL CHARACTERS.

	No. of bolls per plant.	*No. of sound locs per plamt*	*Clean locs per boll*	*Seed cotton per plant (grs.).*	*Immaturity* %*
S.P.39	21·4	34·5	1·6	61·2	11
S.P.40	19·5	30·1	1·5	57·3	26
S.P.43	22·3	29·5	1·3	61·2	28
S.P.48	17·1	28·4	1·7	58·4	21
S.P.56	18·3	24·9	1·4	48·7	38
S.P.57	17·2	22·9	1·3	47·1	33
S.P.72	17·1	28·1	1·6	51·9	29

*Percentage of locs discarded as immature.

LINT AND SEED CHARACTERS.

Origin.	Ginning Out-turn %	Seed Weight 100 seeds (grs.).	Lint length (mm.)	Area of ellipse on Purity Target.
From U.4/4/2.				
S.P.39 via S.P.13 ... and S.P.20.	37·2	8·0	30·4	33
S.P.40 via S.P.13 ... and S.P.20.	37·0	7·9	30·2	33
S.P.43 via S.P.13 ... and S.P.20.	36·8	7·8	30·5	39
S.P.48 via S.P.13 ... and S.P.22.	36·0	8·7	29·5	33
S.P.56 via S.P.14 ... and S.P.25	34·5	7·6	29·6	69
S.P.57 via S.P.14 ... and S.P.26	34·6	8·3	30·4	52
From *Nariama*.				
S.P.72 via S.P.36 ...	32·2	8·4	30·1	38

N.B.—" Area of ellipse on Purity Target " refers to ginning out-turn—lint length purity target diagrams. It is the area of an ellipse defining the limit of error due to chance P — ·05. The figures can only be compared the one with the other as the units have no particular significance. A low figure indicates a high degree of purity. The area of the ellipse for S.P.1, the great-grandparent of the U.4/4/2 family, was 86.

COTTON VARIETY TRIAL—SERERE.

This was laid out in the form of a 7 by 7 Latin Square. Standard Plots (27 feet by 27 feet) and standard spacing (3 feet by 1 foot) were adopted. The varieties were :—

S.G.29 (now grown almost throughout the Eastern Province).
S.P.35 (Nariama, *i.e.*, No. 17 derivative).
S.P. 1 (U.4/4/2 derivative, 1st generation).
S.P.13 (U.4/4/2 derivative, 2nd generation).
S.P.20 (U.4/4/2 derivative, 3rd generation).
S.P.21 (U.4/4/2 derivative, 3rd generation).
S.P.23 (U.4/4/2 derivative, 3rd generation).

The experiment was sown on July 10th.

Blackarm.—Three counts of the number of plants showing Angular Leaf Spot infection were made : the percentages of infected plants at the last count are given below.

Counts of the number of plants showing Blackarm lesions were made on October 13th and November 15th ; both gave similar results and the percentages of infected plants at the second count are also given below :—

	A.L.S. %		% of Plants with Blackarm lesions.	
S.P.13 ...	60·0		24·0	
S.P.23 ...	93·3	Differences	26·8	Differences
S.P.21 ...	76·4	of	28·9	of
S.P.20 ...	84·6	13·7%	30·2	7·5%
S.P. 1 ...	77·0	are	37·6	are
S.P.35 ...	93·9	significant	84·2	significant
S.G.29 ...	95·7		86·7	

The results of this examination are very striking, showing that the U.4/4/2 derivatives have a resistance to Blackarm which places them in an altogether different class from the Local cotton. Moreover, selection within the U.4/4/2 family has led to a further significant improvement.

Jassid.—It was obvious to the most casual observer that S.G.29 and S.P.35 were susceptible varieties, but as no counts of nymphs were made, this statement cannot be substantiated by figures. In mitigation of this, however, it must be stated that S.P.35 was the worst of the Nariama derivatives, particularly as regards jassid, but unhappily it was the only one of which seed was available for a Variety Trial. Of the U.4/4/2 derivatives S.P.23 appeared to be slightly less resistant than the rest.

Habit.—The Local cotton and its Nariama derivative have a very poor habit, and between them and the U.4/4/2 derivatives there is no comparison. S.P.35 is slightly more upright than S.G.29, but both tend to bend right down to the ground late in the season. Of the U.4/4/2 derivatives S.P.13 is quite the best for type of habit. S.P.1 naturally is less regular for type. The third generation tend to be too tall, particularly S.P.23.

Yield.—Yield is summarised in the following table :—The yield of clean cotton from each variety was ginned separately at a ginnery through ordinary 40-inch Platt's roller gins without special adjustment. All yields are expressed as lbs. per acre :—

	Total yield Seed cotton.	*Clean cotton*	*Ginning %.*	*Clean lint.*	*Lint as % of S.G.29.*
S.P.13	687·1	521·4	37·6	196·0	160
S.P. 1	673·2	523·4	36·8	192·4	157
S.P.21	673·1	528·6	37·8	199·5	163
S.P.20	648·2	495·1	37·6	185·8	152
S.P.23	585·6	457·8	36·8	168·4	137
S.G.29	492·3	393·0	31·2	122·5	100
S.P.35	401·2	323·8	30·1	97·5	80
Least Significant Difference ...	106·6	97·7			
Mean	593·9	463·0		166·0	

District Cotton Variety Trials.

As in the previous season, a four by four Latin Square was planted at each of ten centres. A separate draw was made at each centre. The following varieties were used :—

No.17 (Old standard variety in the Eastern Province now being replaced).
S.G.29 (New standard variety in the Eastern Province).
S.P. 1 (U.4/4/2 derivative—1st generation).
S.P.13 (U.4/4/2 derivative—2nd generation).

Blackarm.—The mycologist made counts at Ngetta and Wanyange of the number of plants seriously infected with Blackarm lesions. These results are very significant :—

	Ngetta.	*Wanyange.*
S.P.13	6%	17%
S.P.1	8%	18%
N.17	31%	35%
S.G.29	44%	51%
Least Significant Difference...	4%	6%

Habit.—Notes were made plot by plot at each centre. The characteristics of S.G.29, S.P.1 and S.P.13 were found in general to be the same as at Serere. N.17 was found to be superior in habit and jassid resistance to S.G.29.

Yield.—The following are yields of unsorted cotton expressed as lbs. per acre :—

		N.17.	*S.G.29.*	*S.P.1.*	*S.P.13.*	*Least Significant Difference.*
LANGO :	Ngetta ...	452	482	578	605	—
	Aduku ...	386	283	359	344	—
	Kaberamaido	614	659	804	1,011	166
TESO :	Nyero ...	375	310	513	520	63
BUGWERE :	Kibale ...	752	652	822	1,064	166
	Kachumbala	379	399	556	665	200
BUDAMA :	Mulanda ...	578	653	825	612	—
BUSOGA :	Wanyange ...	216	207	331	506	161
	Bugaya ...	248	245	296	380	—
	Vukula ...	315	379	390	502	—
Mean		432	427	547	621	42

The seed cotton was picked over and the clean cotton was ginned by plots (not varieties) at commercial ginneries through ordinary 40-inch Platt's roller gins which were not specially adjusted. One gin only was used for the cotton from each centre ; Ngetta cotton was ginned at Ngetta ; the rest were ginned at Agu, cotton from Nyero being passed over a hide roller. The following table summarises the yields of clean lint expressed as lbs. per acre, and the ginning percentages :—

	N.17.	*S.G.29.*	*S.P.1.*	*S.P.13.*	*Least Significant Difference.*
Ngetta ...	82	82	94	111	—
Aduku ...	101	76	107	106	—
Kaberamaido	155	168	214	288	49
Nyero ...	99	86	156	169	18
Kibale ...	187	159	224	294	31
Kachumbala	92	98	153	210	68
Mulanda ...	136	148	221	183	—
Wanyange ...	15	23	31	73	26
Bugaya ...	60	60	78	103	—
Vukula ...	70	85	97	127	33
Mean ...	100	99	137	166	12
GINNING PERCENTAGE ...	30·9	31·9	35·0	36·9	0·4

SPINNING TESTS (1932–33 CROP).

Samples of N.17, S.G.29, S.P.1 and S.P.13 from various centres were submitted to the British Cotton Industry Research Association

and the Indian Central Cotton Committee. The summary made by the former institution may be quoted in full :—

> " S.G.29 is slightly superior to N.17 at Serere, about equal to N.17 at Ngetta and Mulanda, and inferior to N.17 at Wanyange.
>
> " Ngetta and Serere gave the strongest yarns, Mulanda the best looking yarns, and Wanyange the poorest yarns—taking into account both strength and appearance. S.P.1 is better at Ngetta than at Serere ; there is little to choose between S.P.1 and S.P.13 at Serere, except that S.P.13 gave yarns slightly inferior in appearance than those spun from S.P.1 (Serere)."

The report from the latter institution is in all essentials similar. Neither institution compares the U.4/4/2 family with the local cottons directly, but it is noted from the spinning data that the former is shorter, does not spin at the same high counts, and it entails a 14% loss of premium.

In view of the fact that the lint character and spinning quality of S.P.1 and S.P.13 are considerably behind the standards set by the present Uganda cottons, whilst in all other characters these strains show a marked advance, it was thought advisable to forecast the possibilities of the family by obtaining the opinion of local lint brokers upon later generations bred at Serere.

The brokers' opinion indicated that there is a distinct possibility of further improvement of the lint characters of this family with continued selection.

Summary of Progress in Cotton Breeding.

The U.4/4/2 derivatives have fulfilled the requirements of (*a*) High yield ; (*b*) Good habit ; (*c*) Resistance to drought ; (*d*) Tolerance to Blackarm disease ; (*e*) Tolerance to jassid attack ; (*f*) Very high ginning outturn. But they do not fulfil the standard of lint character as set by the present Nyasaland Upland types.

The strain S.48 in the new selections, being derived from S.G.29, has shown improvement over Nyasaland Upland bulks (*e.g.*, N.17 and S.G.29) in the following characteristics :—

(*a*) Yield appears at this stage to be better than that of S.G.29 or N.17 ; (*b*) Much more upright in habit ; (*c*) Greater tolerance to Blackarm disease ; (*d*) Much more tolerant to jassid. (It has dense bristly hairs on the leaves, the hairs on the leaves of S.G.29 being sparse.)

The Nariama group—derived from N.17 bulk—has continued to shew marked resistance to Blackarm, but it is still very susceptible to jassid, and has shorter lint than S.G.29 or N.17.

Dr. Harland's Hybrids. It is too early to make pronouncements, but after discarding those susceptible to Blackarm and jassid, a few promising strains and individual plants have been selected for further trial. The groups which shew the most promise are :—(*a*) U.4. × Jamaica Xerophytic with or without Cambodia ; (*b*) (U.4. × Cambodia) × U.4. ; (*c*) U.4. × Meade.

COTTON INCREASE PLOTS AT SERERE.

	Acreage.	*Yield of seed cotton (lbs./acre).*
S.P.20	0·25	581
S.P.21	0·25	583
S.P.23	0·25	406
S.P.36 (Nariama)	0·25	259
S.G.29	3·00	543
S.G.29	10·00	275

COTTON SEED MULTIPLICATION—SEGREGATED AREAS.

The scheme described in last year's Report has continued to operate. The variety S.G.29 was planted throughout.

(*a*) *Mulondo.* Planting was much delayed by the illness of the local chief, and there was a high proportion of late sown cotton. The seed was S.G.29 grown at Serere in the previous season. An agricultural survey of the area was made to ascertain its working strength.

(*b*) *Labori—Kadunguru.* S.G.29 seed grown in Mulondo in 1932/33 was supplied to this area.

(*c*) *Serere—Kasilo.* S.G.29 seed grown in Labori-Kadunguru in 1932–33 was supplied. Seed from the 1932–33 crop was sent to Bugwere District and to North and Central Bugishu. Seed from the 1933–34 crop has been sent to Central and South Bugishu and to Budama Districts. Both issues replace the variety N.17. The second distribution to Central Bugishu was occasioned by changes in the plans for the zoning system introduced in the 1934 buying season.

The yield statistics for the three segregated areas are as follows :—

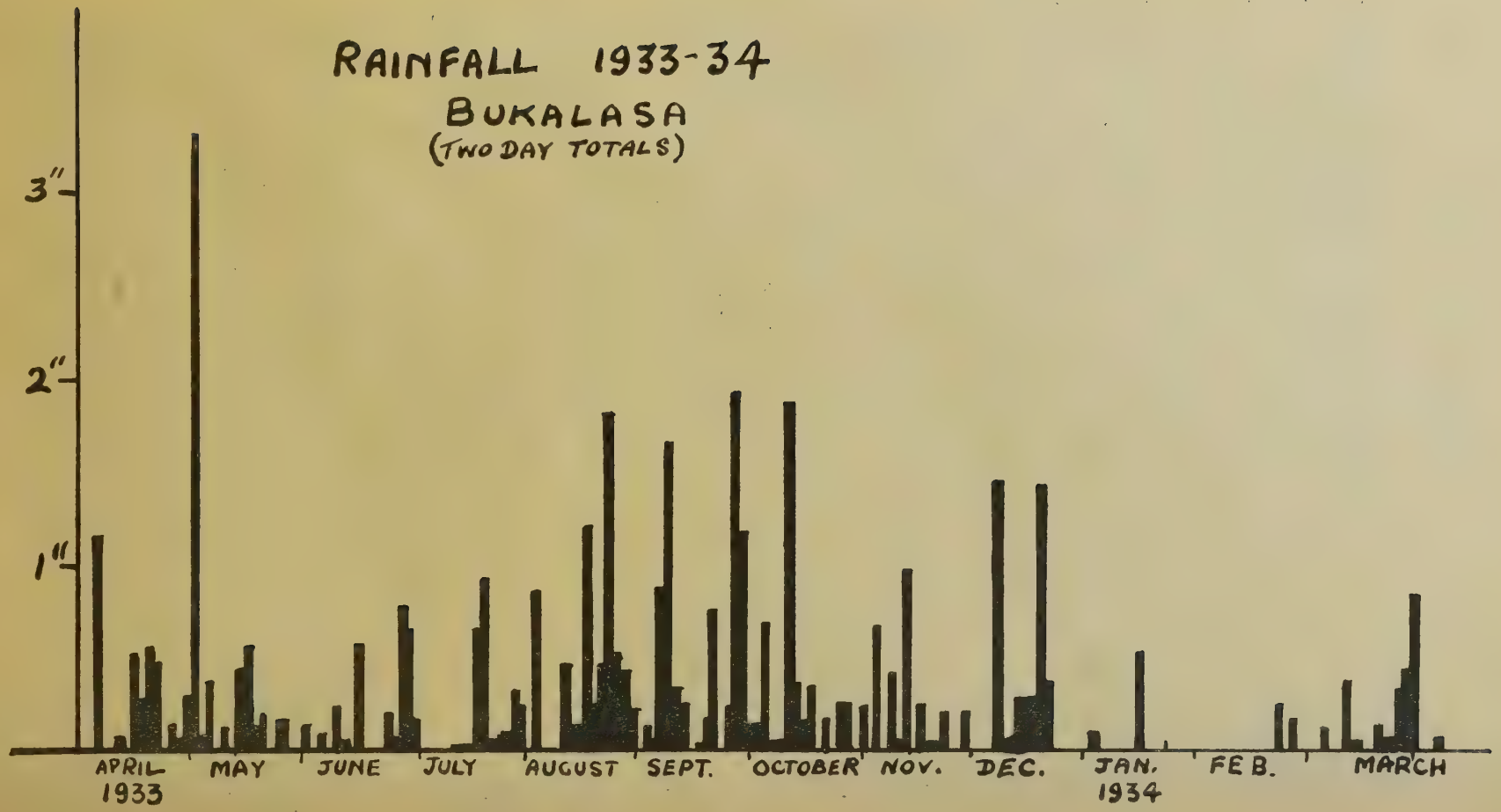
	Acres.	*Buyings lbs.*	*Yield per acre.*	*% Stained cotton.*
Mulondo	362	133,031	367	9·7
Labori-Kadunguru ...	4,821	1,355,385	281	12·6
Serere-Kasilo	28,785	7,807,514	271	13·1
Total	33,968	9,295,930	274	13·0

The average prices realised by natives were :—

"A" quality—Shs. 8·97 per 100 lbs.
"B" ,, —Shs. 6·54 ,, ,, ,,
"C" ,, —Shs. 4·00 ,, ,, ,,

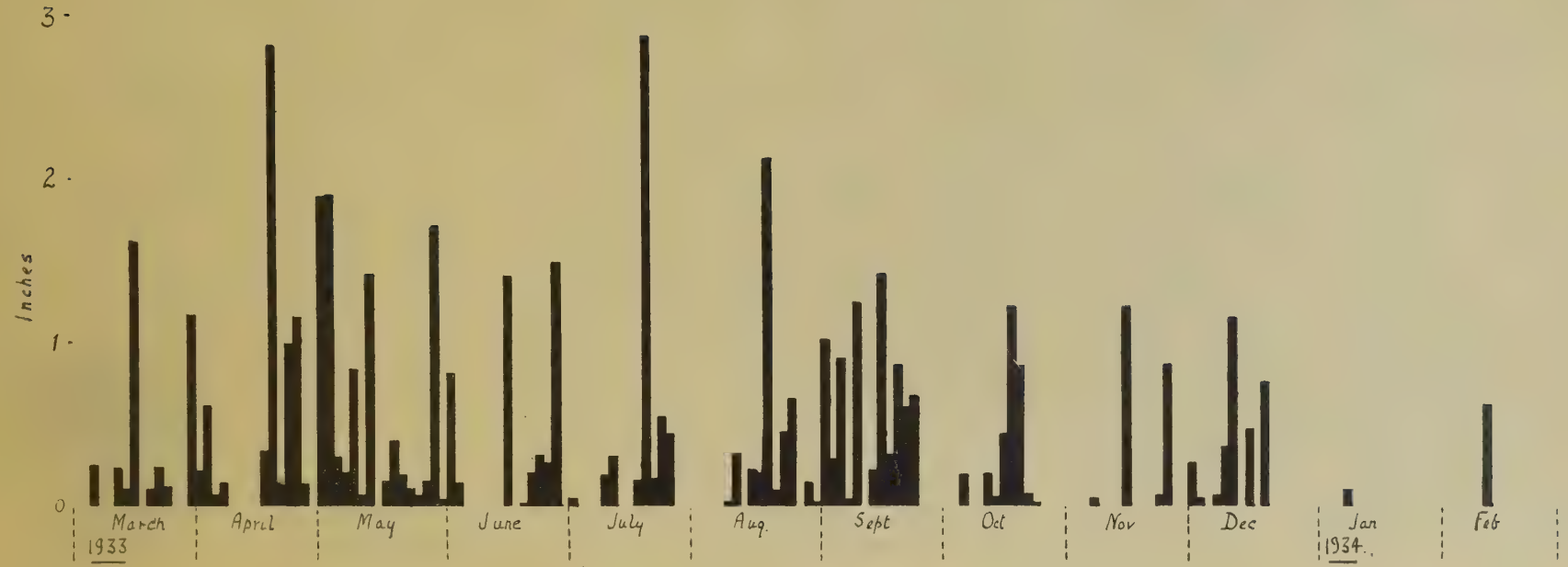
Mulondo Survey. This showed that alien tribes from across the lake, who make up 34% of the population, are not such efficient cotton growers as the native Teso. The average family of one tax-payer, two other workers and one non-worker, plant an average of 1·85 acres of cotton. The Teso tax-payer, on the other hand, plants an average of 2·40 acres of cotton.

In conclusion it is desired to acknowledge the valuable co-operation and assistance of Messrs. East African Ginneries, Ltd., Messrs. Liverpool Uganda Company, Ltd., Messrs. Foster Bros., Ltd., and Messrs. Bombay Uganda Company, Ltd.


RAINFALL 1933-34
BUKALASA
(TWO DAY TOTALS)
3"
2"
1"
APRIL 1933
MAY
JUNE
JULY
AUGUST
SEPT.
OCTOBER
NOV.
DEC.
JAN. 1934
FEB.
MARCH

SERERE RAINFALL

1933 - 34



[*Included by courtesy of the Tanganyika Government.*]

TANGANYIKA TERRITORY.

MOROGORO AGRICULTURAL STATION, PROGRESS REPORT FOR THE SEASON 1933-34.

BY

J. ROBERTSON.

Climatic Conditions.

The year 1934 was characterised by the unusual distribution of the rainfall, a feature common throughout most of the coastal belt of Tanganyika for this particular year. Usually, the greater part of the precipitation falls from the beginning of February to mid-May, after which it decreases considerably, and from mid-May to September or October, dry conditions prevail which are beneficial to the ripening-off of crops. In the present year the rainfall continued at a fairly high rate into the months of June, July and August, with the result that ripening conditions (particularly of the cotton crop) were extremely unfavourable. The following table gives the monthly precipitation for the years 1933–34, together with the average for the years 1925–33 :

TABLE I.

Rainfall in Millimetres.

Month.	*Average.*		
	1934.	1933.	1925–33.
January	75·0	203·4	105·3
February	35·9	72·9	88·4
March	183·9	59·4	141·5
April	142·8	112·8	159·9
May	99·3	26·2	75·5
June	31·3	0·0	16·9
July	16·1	1·1	6·8
August	18·3	6·4	9·8
September	1·0	2·9	20·5
October	—	8·5	23·9
November	—	41·8	39·3
December	—	29·1	101·7
Total (mm.)	—	564·5	789·5
„ (inches)	—	22·2	31·1

Cotton.

The scheme of cotton selection work started in 1932 has been continued during the present year. Briefly, the work consists of the selection of high-yielding types from the commercial strain of Upland

American cotton grown locally, while at the same time an effort is being made to improve the quality of the lint. Imported cottons have not shown the degree of improvement sought for, and while importations will continue to be made, the bulk of the work will be concerned with selection from the local commercial strain. Lint characters of the commercial cotton vary to a considerable extent, but several of the selections originally made in 1932 now show a remarkable degree of uniformity. The most promising strains are :—

244.—A fairly tall strong-growing type which, together with No. 245, gave the best yields in 1933. This type is not very uniform at present and should provide valuable material for re-selection.

245.—Similar in type to No. 244. Yielded very well in 1933 but has not given such good results in 1934 on account of jassid, whitefly and aphis.

249.—A small, early-maturing type. Very uniform. Fine wooded and carrying a very good crop of bolls. Damage by jassid very slight. Boll shedding very slight.

250.—Very similar to No. 249 in habit, but earlier. Uniform in type.

251.—Smaller and earlier in maturing than the local parent material although not so early as either No. 249 or 250.

253.—Not so tall-growing as either 244 or 250 ; a good cropper.

The unfavourable climatic conditions experienced during the present year have been of considerable value in detecting strains of doubtful vigour. Jassid (*Empoasca* spp.), whitefly (*Bemisia* sp.), and aphis (*A. gossypii*), were present in much greater numbers than in previous years, and it has been possible to discard at any early stage types which have not stood up well to these pests. Selections No. 244 and No. 245 were by far the two best in 1933, yet both were badly attacked by jassid in the present year. These two types possess good lint characteristics, however, and will be retained for re-selection for jassid resistance.

Progeny Plots of 1933 *Selections.*—Of the selections made in 1933, eleven were planted out in progeny plots during the present year, and nine were discarded.

Long Staple Types.—In 1933 three plants were selected from the local commercial cotton of a different type from the local strain of American Upland. These possess very good characteristics as the following table shows :—

Selection No.	*Weight of 100 seeds.*	*Lint index.*	*Ginning percentage.*	*Lint Length.*
	grms.			
37	13·50	6·56	32·7	1⅛″–1⅜″
38	11·54	5·70	33·0	1⅛″–1⅜″
322	13·84	7·10	33·9	1⅛″–1⅛″

These were planted out in progeny plots in the present year and have shown a considerable amount of variation, but as there exist within this group plants possessing a lint length of 1½ inches, the lint being particularly strong and silky and free from "nep," plants showing a very high resistance to attack from jassid and whitefly with a yield of seed cotton considerably in excess of individual plant yields from the commercial strain, it should be possible in the near future to fix a type combining the good qualities of the group. Of the selections made from this group during the present year. No. 468 (ex No. 322) has bred true for a maximum lint length of 1⅜ to 1½ inches, while it also possesses a habit suitable for local conditions.

Single Plant Selections made in 1934.—Selections have been made from ordinary district cotton, from progeny plots of 1933 selections and from multiplication plots of 1932 plants. A considerable degree of uniformity has now been obtained in the 1932 selections and improvement is now being sought within these types rather than by selection from outside sources.

Moco Cotton.—The Moco cotton (*G. purpurascens* Poir.) received from Dr. Harland, Trinidad, in 1933, has not given good results during the present year. The plants were vegetative in habit compared with those of Upland American, the bulk of the plants being 4½ feet in height. The plants suffered very severely from insect attack.

Only a very small amount of seed cotton was obtained from these plants in this, their second year of growth. Most of the bolls opened very badly and internal boll rot was particularly severe. The maximum lint length obtained was 1⅛ inch, the ginning outturn being 24·7%. The plants have been ratooned during the present dry season and will be retained for trial in 1935.

Rotation Crops.

Sorghums.—An attempt has been made during the present year to classify the local types of sorghum and to obtain data on relative yielding capacities. Several types exist, from the loose panicled hard-grain type to the close-headed, very soft-grained varieties. There are four main types: (i) Karachi group.—White-grained, white or yellow glumes, open-headed. (ii) Jebere group.—White-grained, black glumes, open-headed. (iii) Kobero group.—Reddish-brown grain, black or yellow glumes, open head. (iv) Kihemba-usungu group.—Reddish grain and glumes, close head. Not eaten by birds.

Group (i) contains the high-priced varieties of which Karachi and

Bangala are the most typical representatives. Jebere is the predominant variety in the hills; Kobero, a higher-yielding type was formerly grown there, but is no longer planted; a reintroduction of this type should prove advantageous. Kobero is a large-grained type immune to attack by birds, which fetches a comparatively high price. Selected plants have been made from these types this year.

Maize Variety Trial.—Certain of the recent productions of maize hybrids in South Africa were received here for trial purposes, together with some of the recognised standard varieties. These were tested out during the year, using Potchefstroom Pearl as control :—

Treatment Means.	*Yields.*
Peruvian	733·5 lbs. per acre.
Boesman	905·5 „ „
Natal 8-row	1,250·0 „ „
Synthetic I	1,283·5 „ „
Chester County	1,316·5 „ „
Sire Cross	1,325·0 „ „
Anveld	1,350·0 „ „
Ladysmith White	1,550·0 „ „
Hickory King	1,741·5 „ „
Potchefstroom Pearl	2,116·5 „ „

A difference of 340 lbs. between any pair is significant, therefore—

(i) Potchefstroom Pearl has given a significantly higher yield than any other variety.

(ii) Hickory King is superior in yield to all varieties except Potchefstroom Pearl and Ladysmith White.

(iii) There is no significant difference in yield between Synthetic I, Anveld, Sire Cross, Natal 8-row and Chester County.

The difference in yield between Potchefstroom Pearl and Hickory King is surprising since the two are usually regarded as practically equal yielders. The new varieties, Synthetic I and Anveld, have not shown up well against the standard varieties. Peruvian, Boesman, Natal 8-row and Chester County, are yellow flint maizes more suited to drier conditions, and consequently they have not shown up particularly well. The experiment demonstrates that in a year of high rainfall fairly well distributed the large-grained white dent varieties are the best yielders.

Maize Manurial Trial.—A simple manurial trial of White Cango maize was laid down in the multiplication block in order to test the increased yield obtained from the use of farmyard manure. The trial took the form of a half drill strip experiment, the manured plots receiving farmyard manure at the rate of 8 tons per acre in December before the land was ploughed. Planting took place in March using a Ransomes two-row Pilot planter. The yields per acre from the

manured and unmanured plots were :—manured, 2,004 lbs. per acre ; unmanured, 1,560 lbs.

Cover Crops.—A series of trials of cover crops has been conducted at Morogoro during the last few years in order to test cover crops suitable for local conditions. Madagascar Butter Bean has given consistently good results over a number of years and is considered by far superior to any of those tested. In addition to forming an effective ground cover which persists right through the dry season it provides a seed of value both for food for human consumption or as an export crop. The following table gives the weights of green matter per acre obtained from the plots this year.

Madagascar Butter Bean	8½ tons.
Dolichos lablab	4½ „
Lima Bean (*Phaseolus lunatus*)	2 „
Sunn Hemp	1 „

Cattle.—A dairy herd of Friesian and Ayrshire grade stock has been maintained at the Agricultural Station since August, 1932, the animals being mostly three-quarter bred. The main difficulty encountered in the keeping of this grade herd has been the incidence of Trypanosomiasis (chiefly *T. congolense*), and although actual losses have been kept low by means of systematic treatment, the incidence of the disease has been remarkably high. No such difficulty has been experienced in the herd of native cattle, and although some of the latter have been attacked by the disease, there have been no relapses which are so common with the grade stock. On account of the ability of the native stock to resist attacks of Trypanosomiasis an attempt is being made to produce a high-milking strain of native cattle. Milk yields of the grade herd have averaged 3,112 lbs. per animal in a lactation the maximum yield recorded being 5,289 lbs. Three of the native cows have been in milk during the present year, the best yielder giving close on one gallon per day and bidding fair to equal the average yield per lactation for the grade herd.

The animals are maintained on grazing only during the rainy season but are stall fed throughout the dry season. The edible Canna has proved invaluable, since both leaves and rhizomes can be fed to the stock. Madagascar butter bean has also been very valuable in stall feeding, while it is also possible to graze this crop. The most useful component of the grazing area is *Panicum maximum*, a grass which gives a very high yield and is readily eaten by stock. Recently, an area has been planted up with Rhodes Grass (*Chloris gayana*) to provide a grass suitable for hay-making, while a local species of

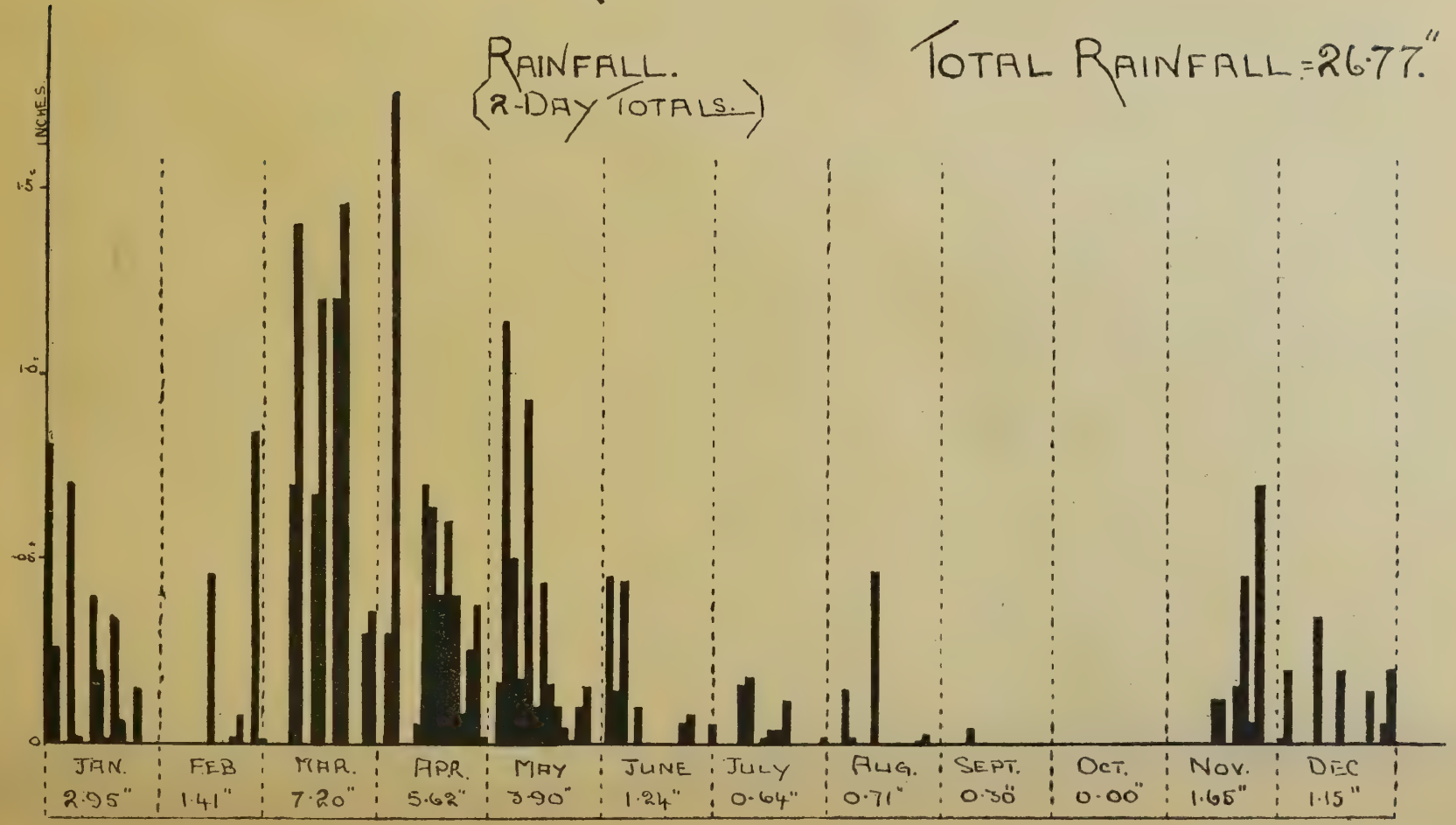
Digitaria, which grows readily in certain hill parts, has been planted at the station.

The work oxen have done excellent service in reducing costs of cultivation on the station, all the land now being ploughed by this means. Ransome's E.C.A. ploughs have proved the most useful type, but a light type of plough, the Ransome's " Hindustan," which can be pulled by two oxen, has given very encouraging results in preliminary trials. It is capable of turning a good furrow and can bury green manures or farmyard manure effectively. It is estimated that this plough (ironwork only) can be supplied locally for Shs. 14/–, which is remarkable value in comparison with the cost of the E.C.A. plough. Also, six oxen are usually required for the E.C.A. while two are sufficient for the " Hindustan." This type of plough will be used in the peasant holdings to be established at Morogoro.

MOROGORO. Nov. 1933. – Oct 1934.

RAINFALL.
(2-DAY TOTALS.)

TOTAL RAINFALL = 26·77"



NYASALAND

COTTON EXPERIMENT STATION, DOMIRA BAY, PROGRESS REPORT FOR THE SEASON 1933-34.

BY

H. C. DUCKER, W. L. MILLER AND S. T. HOYLE.

General.

The rains broke at about the usual time in December, but were very light to begin with and the first real planting rain did not fall till Christmas Day. The ten days previous to this were an anxious time, as some cotton had been planted in the expectation of heavier rains to follow, and when these did not materialise it was feared that the earlier plantings would die. However, they survived the temporary drought, and the whole station was planted up by the end of December. For the next three months there was a normal amount of rainfall, and owing to an unusually wet April, the total for the season was up to expectations.

After the late start it was expected that the cotton plants would not be able to make the framework necessary to produce a high yield. In January and February, however, they grew rapidly ; there was no drought period to cause a check in growth, and they flowered freely. The final result over 44 acres of bulk cotton was 260 lbs. lint per acre, an increase over last year of 10 lbs. per acre, but this year there was practically no locust damage. Thus, in spite of a bad start to the season, Domira Bay once more lived up to its reputation of being a safe place in which to plant cotton.

This season was the first in which the full 150 acres have been under cultivation, and the yields of the latest cleared fields in their first year indicate that they are likely to prove some of the best land on the station. In the coming season the first cleared land is due to be planted with cotton again, and it will be interesting to see how it behaves after the first rotational cycle has been completed. An effective system of storm drainage has been completed, any fields with a pronounced slope have been ridge terraced, and it is confidently expected that there will be no trouble from erosion.

Cotton.

Breeding work.—This year the breeding block suffered some damage from a miniature cyclone which also unroofed the newly-built laboratory. None of the sub-strains were totally destroyed, but a number of plants

were damaged by the wind, giving rise to a stunted growth which made selection work difficult. The same lots were carried over from last year, and a rough analysis showed that many of these were splitting for various characters. It is proposed in the coming season to make a complete classification of all the available stocks and endeavour to eliminate the redundant strains. None of the special lots show evidence of giving greatly increased yields over the bulk U.4 now in general distribution, but some of the sub-strains have a considerably higher ginning percentage.

The crosses have been taken a stage further and it is hoped that some strains will be fixed shortly. The crosses between U.4 and Cambodia, and U.4 and Over-the-Top, are the most promising to date. Some crosses were made this year between high-yielding strains of U.4 and a Moco variety sent by Dr. Harland.

Some 200 crosses were sent from Trinidad by Dr. Harland, and these were grown in observation rows, with results as follows :—

(*Cambodia*×*Jamaica Xerophytic*)×*U*.4.—Most of these were jassid susceptible, and some had such poor growth that they were discarded. Two were retained for further trial.

(*U*.4×*Jamaica Xerophytic*)×*Upland*.—All except two were badly attacked by jassid and have been discarded.

(*U*.4×*Cambodia*)×*U*.4.—None of these was jassid susceptible, and they had a similar type of habit to the crosses made locally with the same parents. The six best rows from the point of view of lint length and yielding power were harvested.

(*U*.4×*Gambia*-14)×U.4;(*U*.4×*Gambia*-14)×*Cambodia*.—Both these crosses resulted in mainly jassid-resistant types, but the lint was so short and wiry that they are considered of doubtful use for this country. The bolls were very small and some of the rows were exceedingly prolific ; two have been kept for crossing with a variety with better lint qualities.

(*Cambodia*×*Galapagos*)×U.4.—The whole of this lot was so badly attacked by jassid that it was not thought worth while retaining any of them.

Strain Trial.—This was a repetition of last year's trial, when eleven strains were put into two 6 by 6 Latin squares, U.4-2 appearing in both as a control. Unfortunately the field used for this experiment proved to be more uneven than was anticipated, and neither of the trials gave statistically significant results. The order of yield for the various strains was substantially the same as last year, with the exception of U.4-4-2.955, which fell from second to tenth place. This strain, though exceptionally early and producing a small compact bush

in a good season, does not stand up as well as the other strains to adverse conditions. It would not, therefore, seem advisable to plant it except in situations where the climate requires the planting of a very early type to the exclusion of other considerations. Six of the other strains are known to give reasonably high yields under average conditions, and at the same time are able to produce abnormally high yields under specially favourable conditions of climate or soil. A mixed bulk of these strains is being given out for general distribution.

Spacing Trial.—This was a repetition of last year's experiment with nine spacings ranging from 14,500 to 29,000 plants per acre. In addition, the same density was arranged in different ways, *i.e.*, 1 foot between holes and 2 plants per hole, 2 feet with 4 plants and 3 feet with 6 plants per hole ; the distance between rows was 3 feet in all cases. At planting the spacings were made very accurately and a heavy seed-rate applied, and each plot had practically a full stand. The average yield on this field was 300 lbs. lint per acre. Once again there was no significant difference between the spacings, and one is more and more forced to the conclusion that within wide limits the spacing of the plants makes no difference to the final yield under Domira Bay conditions. The only certain conclusions from these experiments is the well-known one that close spacing produces an earlier crop, but under Domira Bay conditions the final yield is not affected. The experiments will be continued for another year and a rather more elaborate analysis of the crop attempted. The results will then be discussed in detail and if no further problems present themselves the experiments will be abandoned.

Lilongwe.—A piece of the Government Experimental station was again used for the cotton plots. Owing to the late season or other causes the results from the selections were not as good as had been hoped. Staining was very bad and only a few of the selections showed promise of giving anything approaching a commercial yield. Selections from Gatooma are being tried in the coming season as it is thought that the climate resembles that of Gatooma more than any of the present cotton areas in Nyasaland. It is obviously essential to have a quick-maturing cotton as the climate makes growth very slow and there is the danger of frost killing the cotton in June.

Pests.

Locusts.—The first flying swarms of red-winged locusts made their appearance on the station early in December, five weeks earlier than last year and considerable damage was expected. Breeding took place on and around the station about mid-December. These old flying

swarms ate some freshly-germinated maize, but did not kill it; they did kill, however, the early-planted beans. Many of the egg-masses were parasitised by the larva of a Cantharid beetle and so few hoppers emerged that no appreciable damage was done. At the end of March a small swarm of fully-grown hoppers approached the station, but these were killed, or died of a fungus disease, before any harm was done. Several young flying swarms passed over the station in early April on their way from the lake shore to the hills. Some of these swarms settled on the cotton for the night and caused some bolls to drop off by eating the bark, but the total damage was very slight, less than last year and far less than had been feared at the beginning of the season.

Stainers.—A start was made in recording the infestation of stainers on the station, using the method worked out by the Insect Pest Control section at Barberton. The method worked satisfactorily and a good idea of the nature of the attack was obtained. Recording was begun in March and continued till June when the crop was harvested. From March till the middle of May there were less than 500 stainers per acre; the numbers then rose rapidly to a peak of 5,000 per acre at the end of May, and fell off again in June. Except for a period at the end of April, *Dysdercus fasciatus* was much the commonest species, being from 3 to 8 times as numerous as the next commonest species, *D. intermedius*. *D. superstitiosus* was found in small numbers throughout the season, and *D. nigrofasciatus* was only recorded once. The degree of staining was never great, being a maximum at the beginning of the season, falling to a minimum and rising again at the close of the season.

The following wild host plants of stainers occur. (1) *Sterculia triphaca.*—These trees are quite common in the vicinity of the Station and flower at the end of October. *D. intermedius* is the only species which has been recorded, first becoming common in February and rising to a maximum in May–June. (2) *Baobab.*—This species is common near the cotton station and its flowering habits are somewhat similar to *Sterculia*. All four species of *Dysdercus* have been recorded on it, *D. fasciatus* being by far the most common. Stainers have been collected from January onwards and the numbers rise to a maximum in June. (3) *Thespesia rogersii.* This species is not common on the lake shore and is not considered an important host plant. Only *D. fasciatus* has been recorded and never in large numbers. (4) *Hibiscus spp.*—There are at least five species of this genus which are commonly found in the bush and these would appear to provide a good breeding ground before the cotton is in an attractive state. The

commonest species found on these plants is *D. intermedius*, followed by *D. superstitiosus*. *D. fasciatus* has only been recorded occasionally.

Rotations.

The main rotations of the Station, as detailed in previous reports are pigeon pea, maize, and various beans under observation.

The area under maize has been retained at 30 acres, consisting of 20 acres of Potchefstroom Pearl and 10 of Honduras Yellow. Although some difficulty was experienced at planting time, owing to light rains, the final stands and yields were excellent. In the coming season it is intended to make a large number of selections from native-grown maize for growing on the station as a cob-to-row experiment. The selections will be confined to a small, hard, white dent type, which it is hoped will be suitable for export.

The chief difficulties in obtaining successful crops of beans have been damage by locusts and inexperience of the correct time of planting. In this connection it is interesting to note that in this area the native grows his main crop of beans as a winter crop on land which is naturally sub-irrigated. The varieties grown—Bush Lima (*Phaseolus lunatus*), a white kidney selection (*Phaseolus vulgaris*), Tepary, and Green Gram—should all do reasonably well, and will continue to be grown, and experiments carried out to obtain further knowledge of the time-of-planting problem.

Groundnuts are a success and may become an important native export crop. There are now three strains grown on the station :—a bunch variety (Spanish) from Makwapala, a selection made at Barberton, and a variety from Gambia said to be resistant to rosette disease. The five acres of Spanish bunch yielded nearly 1,500 lbs. per acre. The two other varieties were grown as garden plots. The one from Barberton appears to be much more suceptible to rosette disease than the other two.

In addition to the main Kenya bulk of pigeon pea, there are three varieties from Pusa which have ratooned successfully and will be kept under observation, also a white variety of Dr. Harland's. In view of the locust menace, which continues, several seed stocks of varieties of cassava and sweet potatoes are being kept up.

Buildings.

The programme of new works commenced last year has provided the station with buildings which should prove sufficient for a considerable time to come.

The laboratory, store, and two offices under one roof, were completed just before the 1933–34 rains. During the present dry season another dwelling house, garage and boys' quarters, ginnery, maize store, and a building to house the bore-hole pump and motor have been practically completed. It is still hoped to erect a garage for the use of visitors.

The house is built on the same plan as the original one built in 1931, with minor modifications for general convenience and appearance. The ginnery and power-house is a copy of one belonging to the B.C.G.A., about 7 miles from the station, with the addition of a store for seed and baled lint and a lean-to for the disintegrator. All the plant, including Robey steam engine, cotton press, two 40-saw gins, shafting, etc., which are on loan from the B.C.G.A., have been installed and used for the ginning of this year's crop.

In addition, the steam plant will be used to drive the disintegrator and a dynamo for supplying electric light to the houses and offices, and power to drive an electric motor to operate the borehole pump.

The maize store planned to hold approximately 30 tons of maize in the cob, is built to allow the free passage of air through the stored grain.

The water from the bore-hole is pumped into an elevated tank and runs thence to the houses and office by pipe lines. A water channel has been constructed so that the garden plot may be irrigated. The garden plot is of sufficient size to provide for all domestic needs, and also to allow room for special lots of cotton. By means of irrigation it will thus be possible to grow two generations of cotton in one year and so considerably speed up the breeding programme.

The Cotton Industry in Nyasaland.

Owing to the improvement in price and increased yields, and also to an energetic drive on the part of the Government, there has been a considerable expansion in the native cotton industry in the Lake shore areas, both on Crown land and by tenants under European supervision.

The most striking example of the latter is on Mr. Wallace's Chikwawa estate, managed by Mr. Walkington, about ten miles to the north of the cotton station. Special mention is made of this estate as the whole of the bulk seed from the Station in 1932–33 was grown there in the year under review. The resulting seed cotton has been sent to Port Herald to be ginned separately, and the available seed, about 100 tons, will be used to plant up an isolated area in the Port Herald district in 1934–35. Thus the whole country will eventually be re-supplied with seed originally grown on the cotton station.

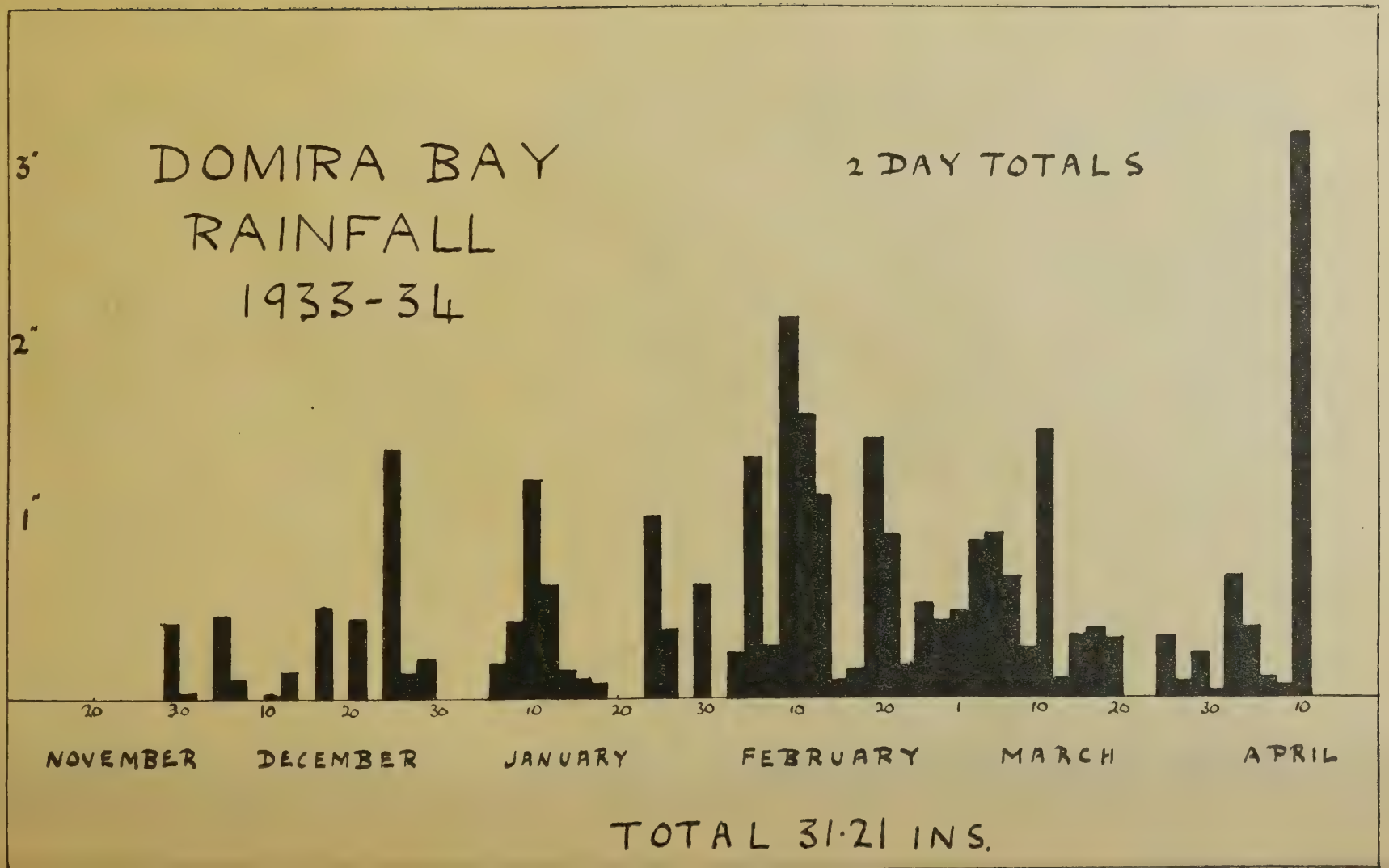
The high yields obtained, amounting to approximately 2,000 lbs. seed cotton per acre, on certain gardens on the land depending entirely on rainfall, have shown very clearly to the natives what a splendid cash crop cotton can be with a minimum expenditure of energy, if the price is maintained at its present level. In addition, a considerable acreage has been planted in land which is naturally sub-irrigated, as a catch crop after the native maize has been reaped. This crop is now being picked (November) and promises to give a useful yield of 400–500 lbs. per acre.

It is probable that there will be 100% increase in the gardens planted during the season 1934–35, both on the Lake shore areas and on the land served by the new extension of the railway. There is a considerable area of dry land suitable for cotton-growing, and the Government's water boring scheme will make much of this available to the native cultivator.

In the Lower Shire valley, this year has shown a slightly increased crop over that of last year. The demand for seed indicates that next year's crop will be larger still, and if present prices continue, it is possible that the record crop of 1928–29 season will be exceeded.

After a lapse of years due to the arrival of the pink bollworm, the Karonga area was issued with seed last season. The response of the natives was disappointingly small, but there are signs of revived interest for the coming season.

The increased price has provided the stimulus to the native grower which, if maintained, should result in largely increased exports in the next few years.


DOMIRA BAY
RAINFALL
1933-34
2 DAY TOTALS
3"
2"
1"
20
30
10
20
30
10
20
30
10
20
1
10
20
30
10
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
TOTAL 31·21 INS.

NIGERIA.

PROGRESS REPORT FROM THE CORPORATIONS SEED FARM, DAUDAWA, 1933-34.

BY

G. BROWNE AND A. E. CASEMENT.

The following Report covers the period November 1st, 1933, to October 31st, 1934.

CROPS.

Cotton.—Owing to the abnormally wet season in 1933, with a rainfall of 57 inches compared with an average of about 45 inches, the crop, not only at Daudawa, but everywhere in the Northern Provinces, had a very difficult time indeed. Fortunately the rains finished early (October 1st) and this gave the ground time to dry up a little and thus saved the cotton from being practically a failure.

In 1933 there were 660 acres planted in Strain " L " ex Maigana. Of these, 220 acres were grown through cereals, the latter being for food, fodder or ensilage. The average yields of cotton were as follows : through bullrush millet (80 acres) 105·3 lbs. seed cotton per acre ; through maize (30 acres) 213·1 lbs. per acre ; through guinea-corn for ensilage (110 acres) 162·1 lbs. per acre, while the cotton grown as a straight crop gave an average yield of only 132·37 lbs. per acre. Before picking, it was believed that the cotton grown through cereals had suffered on that account owing to the apparent choking effect of the latter, but the figures disprove this and seem to indicate that what really happened was that the cereals tended to protect the cotton in the earlier stages when climatic conditions were so adverse. The total amount of No. 1 grade seed cotton produced on the Main Farm was 90,272 lbs., and of No. 2 grade 847 lbs., whilst the No. 1 grade from the Co-operative Farms came to 15,337 lbs. Thus the No. 1 grade seed cotton from both the Main Farm and the Co-operative Farms totalled 105,609 lbs. and produced 32,417 lbs. of lint, giving a ginning outturn of 30·61 %. The greater part (64,960 lbs.) of the seed was sent to the segregated area at Dan Ja, there to be distributed by the Agricultural Department. The remainder was retained at Daudawa to augment the 1934–35 season's seed ex Maigana.

The lint went to the B.C.G.A.'s ginnery at Funtua to be pressed, baled and dispatched to England. The broker's report on the first consignment was " Strict Good Middling, Good colour, Staple 1 $\frac{1}{16}$ inch to 1$\frac{1}{8}$ inch. Wasty and rather neppy. Value 6·40d. (American Futures 5·80d.) " ; and on the second lot : " Good Middling to Strict Good Middling, creamy in colour, Staple 1 $\frac{1}{16}$ inch to 1$\frac{1}{8}$ inch, very wasty and irregular and wanting in strength, value 6·40d. (American Futures 5·90d.)." These reports cannot be said to be really satisfactory and this year some trials are to be carried out to see if the cause of the criticisms lies in the ginning or after-picking treatment of the cotton ; in these trials the B.C.G.A. are co-operating. The No. 1 grade lint sold for 6·41d. per lb. throughout (American Futures being 6·01d.), and the odd bale of gin droppings sold for 3·50d. per lb.

In the 1934–35 season a new selection of Strain " L," weighing 4,900 lbs., was sent from Maigana for use at Daudawa. This was sown in 348 acres on the Main Farm and 89 acres in the Co-operative farms, while 380 acres on the Main Farm were sown with Strain " L " ex Daudawa (from the last year's crop) and 41 acres in the Co-operative Farms had the same seed. Thus altogether there are 728 acres in cotton on the Main Farm this season and an estimated 130 acres on the Co-operative Farms. Planting commenced on July 2nd and ended on the 28th, a record acreage being sown in the record time of 21$\frac{1}{2}$ working days. A fairly generous seed rate was used, about 10 lbs. per acre, and the germination from the first sowings was very good. The first supplies did fairly well, but the second did not ; nevertheless, the stand was remarkably even. Owing to the short time taken in sowing, it was possible to weed and thin the cotton in quite good time, and, as soon as the plants were strong enough, P.I.K. ploughs were put through, which had a very beneficial effect on the crop. Flowering commenced on September 5th, and fruiting has been, and still is, very heavy at the time of writing (November). October rains were very good and there seems little doubt that an excellent crop will be harvested if there is no unforeseen setback. No stainers have been seen yet, but there is some leaf curl and also a little bollworm damage. Stemborers have caused two patches of characteristic damage, and this pest is being kept under observation closely.

A new method of working the farm, which has been of great benefit to the cotton crop, has been successfully tried. The outer portions of the farm, where the bulk of the cotton lies, are worked first, and the fields nearest the labour lines last. There is a natural tendency on a farm of this size to pay more attention to those fields easiest of access for the labour, and to leave the outside fields to the last in all

operations, which obviously has a very bad effect on a crop such as cotton which requires all the attention possible. The result amply justifies the change and the scheme will be adhered to in future.

Maize.—The rains started rather late and this accounted for the failure of the maize crop. Although re-sown three times, practically no crop resulted. The area sown in maize was only 60 acres and cotton was sown through it later.

Bullrush Millet.—This crop did not give so good a yield per acre as last year, the spacing being wider and the later start of the rains having affected the crop. Being grown and harvested under better conditions otherwise, however, the grain is of a superior quality. The total weight (in the bundle) was 59,670 lbs., an average of 271 lbs. per acre over the 220 acres sown.

Guinea-corn.—Yields for the 1933 crop were not included in last year's report and were as follows: Area planted 140 acres; weight harvested, 54,985 lbs.; average per acre 393 lbs. During the present year the crop has done remarkably well and higher yields are expected. As has been the practice in the last two years, some has been sown late for ensilage, the remainder being sown through groundnuts or millet. This year 140 acres have been grown for grain and 60 acres for ensilage, but the latter was not all harvested owing to shortage of room, so, to avoid waste, odd plants were left here and there to come to maturity. These do not appear to have had any adverse effect on the cotton in which they were grown, especially as all the lower leaves were stripped for fodder directly the heads were formed. The crop is not yet harvested.

Beans.—One field of 20 acres was grown in order to see whether the Mucuna beans would kill off the sword grass (*Imperata arundiacea*) which is a particularly undesirable grass, especially where there are cattle. The result was inconclusive as the ground became waterlogged and the beans did not do well. They were turned in at the end of August as green manure. Another small patch, an acre in extent, was sown with beans with a similar object, and this looks like being much more successful.

Green Gram.—About 10 acres of this were grown for fodder, but some seed was taken from part of it, as it is intended to try a new scheme next year in connection with temporary pasturage, and a good deal of seed will be required.

Groundnuts.—Last season 100 acres were sown, 80 of which were in ordinary spreading varieties and 20 acres in "Castle Cary" nuts. The former yielded an average of 419 lbs. per acre, and the latter an average of 386 lbs. per acre. The above are weights of unshelled nuts,

the total shelled weight being 20,216 lbs., a shelling percentage of 60. Of the "Castle Cary" variety, 3,360 lbs. were kept for seed and 4,360 lbs. were sold to a neighbouring Provincial Administration at the request of the Assistant Director of Agriculture.

This year 80 acres of the "Castle Cary" variety have been sown, but are not as yet harvested; it is not thought, however, that the crop will be up to normal. Prices, which were extremely low last season, are rather better this year. The haulms will, as usual, be made into hay and stacked with other fodder crops for dry season use, the producing fields being given instead a good dressing of F.Y.M.

Tobacco.—In order to assist in getting tobacco-growing started in the Northern Provinces, and at the suggestion of the Agricultural Department, a plot of 19 acres was allocated, and 11 acres were eventually planted out in plants from Maryland seed. (The other 8 acres were late-sown with cotton on August 28th, and, thanks to late October rains, promise to do well.) One-third of the 11 acres was given a dressing of 2 tons to the acre F.Y.M., one-third was dressed with nitrate of soda and superphosphate mixed, at the rate of 100 lbs. to the acre, the remaining third being left as control. It was thought that it would be advantageous to ascertain how tobacco would work in with cotton in this country as a rotation crop; it appears, however, to clash with the sowing and weeding of cotton as well as with the lifting of groundnuts. Harvesting is in progress at the time of writing, and the work is being supervised by a B.A.T. Company official, but although yields are not yet available, it seems evident that the section which was dressed with F.Y.M. compares very favourably with that treated with artificial manure. The drying or curing is being done in the farm stores, and all available buildings.

Haygrass.—Twenty acres were laid down to permanent pasture, being sown with the best native grass seeds gathered last year. The field was one very liable to erosion, and is the first of about three to be so treated. The grass was cut green and put down to ensilage, being mixed with guinea-corn leaves, etc. The field was then given a dressing of F.Y.M. and it is hoped to obtain a second crop of grass from it, which will be made into hay. Patches of sword grass were scarified and Mucuna beans sown in order to try to exterminate the former.

Cattle.

Last year the herd numbered 80 head and at the same time this year 167 head, including cows and calves. Of these, 127 are working bullocks, 22 are cows and 18 calves. The cattle purchased during

the year were 97, and 8 calves were born. With this strong herd of working bullocks, it was felt that measures might be taken in order to conserve strength, and with this object in view, 100 animals were allocated to deal with the 1934 work (this allowed for a complete change each day plus a small margin for loss), and the remainder formed the nucleus of what is termed the Reserve Herd. The latter are the most recently purchased animals and to this herd are drafted all animals when first bought. This herd is tended separately and the animals have thus a good opportunity to become acclimatised to Daudawa before being put to work. With increased experience in cattle management in the tropics, a drop in the mortality has been effected : this year only 18 animals have been lost against 30 last year in a much smaller herd. The following is an analysis of the causes of the deaths : Arsenical poisoning, 1 ; Pneumonia, 1 ; Trypanosomiasis, 5 ; Liver disease, 4 ; Vertigo, 1 ; Accidental (goring), 1 ; Not suitable for work, 4 ; Cause doubtful, 1.

The position as regards the tsetse danger has been made much more satisfactory by the visit of Dr. Nash of the Tsetse Investigation Bureau, sent by the Nigerian Government. Much clearing has been done by both the Corporation and the Katsina Native Administration. There is little doubt that this, coupled with the improved methods of keeping and managing the cattle, has reduced the death-rate from Trypanosomiasis. Cattle have only been worked in 4-hour shifts, and temporary covered pens have been put up to provide all possible shelter ; the rations have also been increased. The weekly dipping of the herd also is undoubtedly one of the chief factors influencing the health of the cattle.

The output of F.Y.M. was so great, largely owing to the watering of the bedding during the dry season, that the dressing was able to be increased to 2 tons per acre in place of 1 ton, and no less than 340 acres received this dressing compared with 130 last year at the smaller rate. The manuring of the fields had to be stopped owing to pressure of other work and a good balance of manure remains still to be distributed. It is owing to this supply of F.Y.M. that it was possible to put so large an area under cotton this year ; it would have been absolutely impossible in former years under green manuring.

Labour.

Supplies of labour, while not being actually short, have been more difficult to obtain owing to the local gold-mining activities. In order to counter this, increased numbers of women and young people

have been engaged and these, for some work, are found to be better than the male labour ; they are more willing and more stable than the odd casual labourer, who is apt to drift away when better opportunities of employment are heard of. The average daily attendance increased to 197 ; health has been quite good and there are no diseases of an epidemic nature to report.

Co-Operative Farms.

Last year the estimated area under cotton was 99 acres, and 15,337 lbs. of No. 1 grade seed cotton were produced, an average of 155 lbs. per acre. This cotton was purchased by the Corporation (being from our seed), at prices ranging from 0·9d. to 1·2d. per lb. in accordance with market prices at Funtua. It was ginned and dealt with in the same way as the Main Farm cotton. Two changes in tenancy have been made, and two houses have been built for the farms cleared and put into occupation last year. Two wells were sunk, one being 32 feet deep and the other 60 feet. The former was lined with concrete ; and the second had a concrete head 12 feet deep inserted, but this was not a success and the well collapsed.

This year, the cotton seed sown by the farmers was as follows : 89 acres of Strain " L " ex Maigana and 41 acres Strain " L " ex Daudawa. All farms have excellent crops of both cotton and cereals, etc., and the occupiers should do well financially this year with produce prices opening higher than last season, though grain prices are low.

Water Works.

An additional section has been added to the elevated steel tank, thus increasing the head and reserve supply of water.

Buildings.

A new store was built of the same size as that erected last year, but the new one was constructed from timber (in place of steel members) and galvanised iron sheeting, all bought in the country. The cost was naturally greatly reduced in consequence.

Locusts.

Large flights of locusts have been seen in the distance this year, but only one flight of hoppers visited the farm. They damaged two fields of guinea-corn, but were too late to do any real harm, and yields ought not to be materially affected.

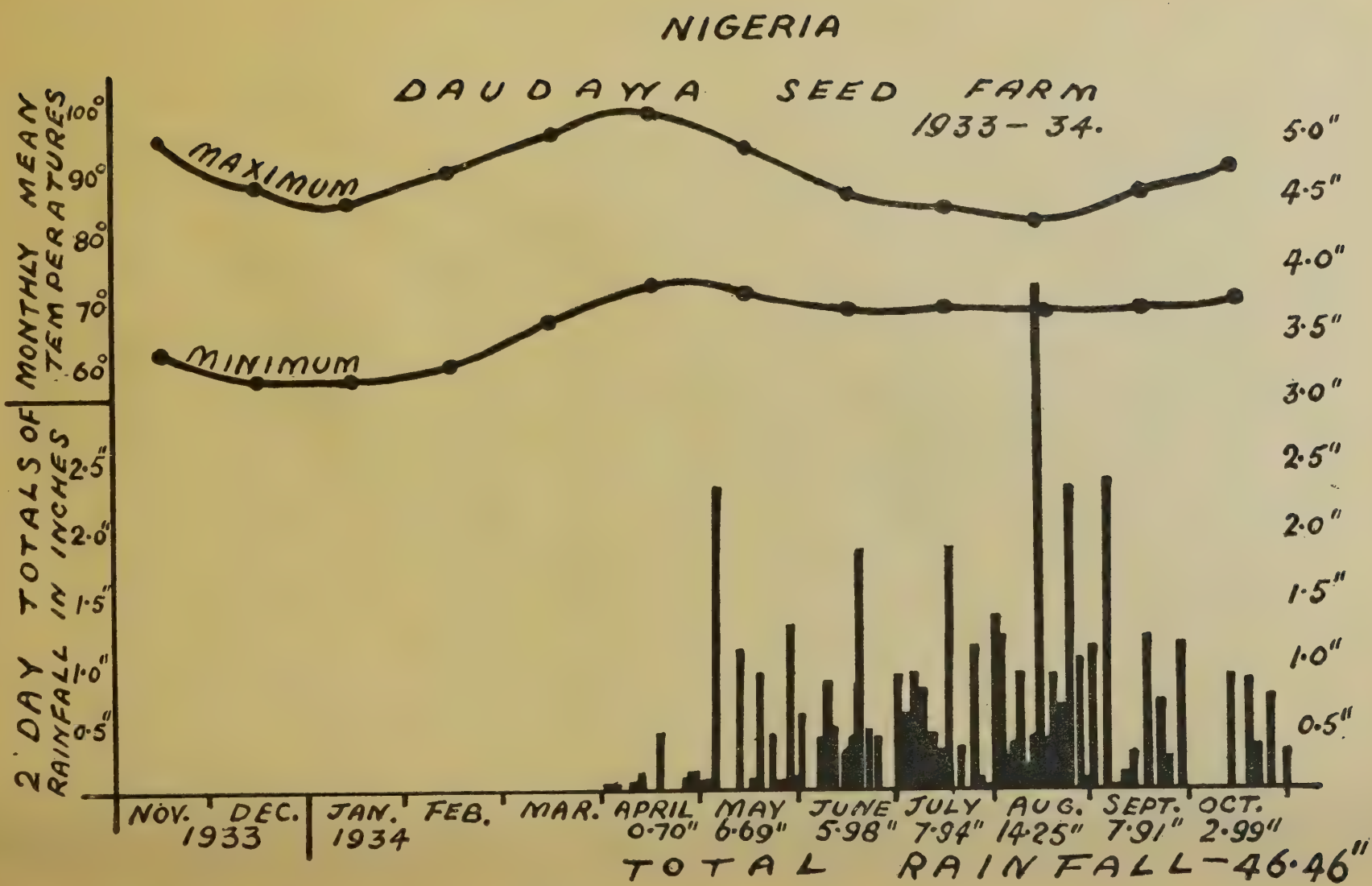
Meteorological Data, 1934.

The first rain fell on April 8th, and the last on October 29th. From the point of view of incidence of rainfall and growing conditions generally, the year has been as near perfect as possible, though August was just a little too wet and retarded plant growth somewhat. The crops, generally, have taken full advantage of the exceptionally favourable conditions, especially the cotton crop, and good yields ought to be forthcoming. A sheet showing meteorological data accompanies this report.

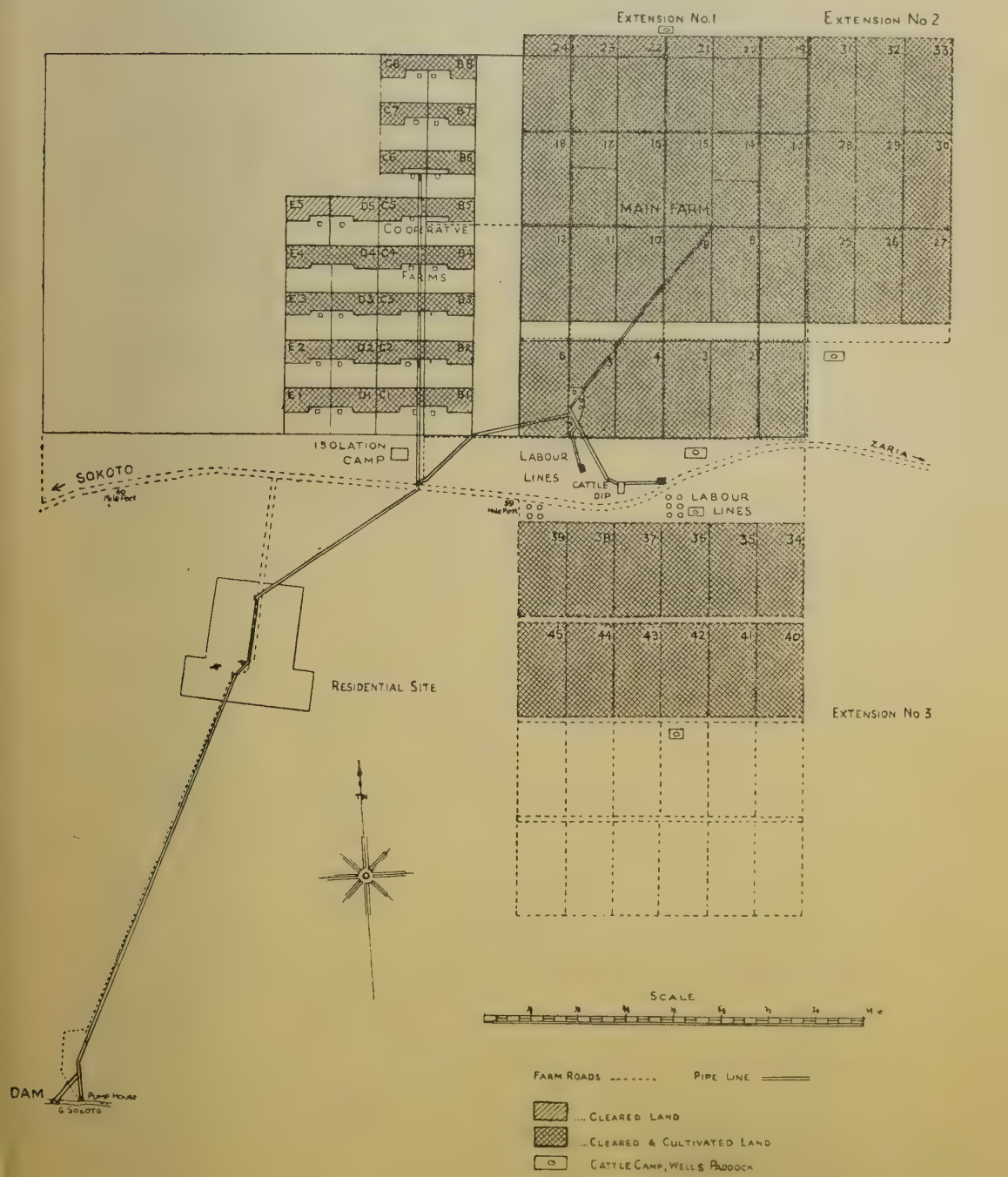
General.

Large numbers of both Europeans and Natives continue to visit the farm from time to time, and express interest in the work.

On behalf of the Corporation and their Staff at Daudawa, the Manager would like to thank the Officers of the Political, Agricultural, and Veterinary Departments for their co-operation throughout the past year.


NIGERIA
DAUDAWA SEED FARM
1933 – 34.
MAXIMUM
MINIMUM
MONTHLY MEAN TEMPERATURES
100°
90°
80°
70°
60°
2 DAY TOTALS OF RAINFALL IN INCHES
2·5"
2·0"
1·5"
1·0"
0·5"
5·0"
4·5"
4·0"
3·5"
3·0"
2·5"
2·0"
1·5"
1·0"
0·5"
NOV. DEC. JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT.
1933 1934
0·70" 6·69" 5·98" 7·94" 14·25" 7·91" 2·99"
TOTAL RAIN FALL – 46·46"

DAUDAWA SEED-FARM, NORTHERN NIGERIA, 1933/34



WEST INDIES.

COTTON EXPERIMENT STATION, ST. VINCENT, PROGRESS REPORT FOR THE SEASON 1933-34.

BY

S. H. EVELYN AND S. C. HARLAND.

The following Report by Mr. Evelyn has been received through, and revised by, Dr. Harland, who is responsible for the direction of the work described.

1. *Experiments with Sea Island Cotton.*

(*a*) *St. Vincent Commercial Superfine* (V.135).—Although it is considered that V.135 is as pure as it can be for commercial purposes, selection is being carried out for agricultural properties, particular attention being paid to yield expressed as the total number of bolls on the main axis sympodia. The progeny of the six highest yielding plants were observed for (1) node number, (2) number of buds shed, (3) number of buds produced, and (4) number of bolls produced. The observations for (2) and (3) were made 70 days after sowing and for (4) 128 days after sowing. Some interesting correlations were observed. Plants with low node numbers produced the highest number of bolls : all plants with 90 bolls and over were selected for a continuation of the experiment.

Two strains were grown from the plants with longest lint in 1932 (lint length 60·4 mm. and 61·0 mm. respectively). The progeny showed no positive results from selection of these high values. Two selections of lint lengths 62·2 and 62·0 mm. have been made to maintain the character of extra long staple. The lint index of these strains increased through some unknown cause from 37 to 45 mg. The environmental causes of fluctuations in lint index are still very little known.

Last season several plants in the V.135 plot were noticed which had shed nearly all their buds and bolls and which remained green and fresh when neighbouring plants were dried up. The question arose as to whether these plants were mutants (chromosomal or genetic) or merely fluctuations ? The " selfed " offspring of three of these plants gave perfectly normal plants with normal yield. The great shedding observed in the previous generation was thus an environmental effect and doubts as to the purity of the strain were thus removed.

The system of annual seed renewal for commercial planting is still carried on. Forty to sixty acres of " selfed " seed from Station-grown pure V.135 are grown in an isolated area each year for sale to commercial growers. By law no other seed can be planted commercially.

(*b*) *Red Sea Island.*—The experiment to transfer the gene R^2 (red plant body-weak spot) from the Trinidad Red Kidney tree cotton to Sea Island V.135 was continued.

After backcrossing the F_1 of Red Kidney × Sea Island ordinary to Sea Island (ordinary) again, two further backcrosses were made. The third backcross was to V.135 superfine. Subsequently the strains have been "selfed." This year nine strains were grown. Seven bred true to red plant body-weak spot, and five of these to superfine lint length. Some of the red plants possess lint lengths up to 68 mm., *i.e.*, above those previously recorded. The yield of the strains is, however, not quite so good as that of the standard V.135, though considerable improvement has taken place in this respect.

Twenty-seven selections have been made for such characters as (1) lint length, (2) lint index, and (3) high bolling. Many of these selections combine (1) and (3). Some of the Red Sea Island selections are now considered pure enough to warrant their being tested against V.135. A comparison of yield, lint length and lint quality will be made between them next season.

Repeated backcrossing of heterozygous red to V.135 has also been continued. The effect of the gene R^2 on lint length has been studied; there is no significant difference in lint length between red and green plants.

(*c*) *Experiment to combine the lint length and quality of V.*135 *with the high yield of Montserrat Sea Island.*—Five plants were obtained from the selfed first backcross and two from the selfed second backcross, combining V.135 length with lint indexes ranging from 49 to 59 mg. and ginning percentages ranging 27·2 to 31·1. The characters of the parents are as follows :—

Strain.	*Lint Length (mm.).*	*Lint Index (mg.).*	*Ginning %.*
V.135	57	43	26
H.39	51	60	34

(*d*) *Studies of the relation of Corolla Colours in Sea Island strains.*—Three major grades of corolla colour occur in Sea Island strains—Yellow (8), Pale Yellow (6) and Cream (2). The last mentioned is a mutant from a yellow parent, and is locally designated "Sea Island White." Employing the repeated-backcross technique, a study is being made of the inter-relation between these three corolla colours and between them and the characters lint length, lint index, corolla spot and leaf callus spot. The first backcross of (Yellow × Cream) × Cream and F_2's of Yellow × Pale Yellow and Pale Yellow × Cream were obtained this year.

2. *Experiments with Perennial Tree Cottons (Moco, Carriacou and Marie Galante).*

Selection experiments with Moco were continued, and a large number of progeny rows were grown. In previous years many of the lines threw recessive naked seeds, and until lines pure for tufted were obtained no strains could be sent out for testing. Some strains are now free from the naked gene, are pure for a lint length of 47-48 mm. and are now ready for extended trial, though the difficulty of obtaining selfed seed of these perennial cottons in St. Vincent is considerable.

Some strains selected from Mr. Simmons' long-linted Carriacou type were also grown.

Comparing the Carriacou type with Moco, it is fairly clear that each type has advantages not possessed by the other. Moco, for example, usually germinates very badly and has creamy lint, both these characters being undesirable. Carriacou has white lint and gives excellent germination, but is probably inferior to Moco in agricultural properties. It will probably be necessary to evolve new combinations of Moco and Carriacou, and F_1's have been made this year. Spinning tests and brokers' reports demonstrate the superiority of the Carriacou lint—the value of which was estimated at 9½d. per lb.

The F_2 of Moco × Marie Galante grown this year gave some excellent plants. Eleven have been retained for progeny rows next year.

The Marie Galante strain is now pure for lint length 49 mm. and is being retained for crossing work.

3. *Experiments with Ishan Cotton from Nigeria.*

The object of this experiment is to see whether the lint length and fineness of Ishan can be improved by crossing with Sea Island, subsequently extracting long-linted strains after repeated backcrossing of long-linted heterozygotes with Ishan.

This year the first backcross of F_1 by Ishan was studied. The following table demonstrates the progress made :—

Frequency Arrays of Length of Parents, F_1 and First Backcross.

	Mean Max. Lint Length (mm.).																	
Strain	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	60	*Mean*
Ishan A–5	—	—	—	*1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36·0
V.135	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1	60·0
F_1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1	—	49·0
1st Backcross (F_1 × Ishan) ...	4	8	5	4	6	10	14	27	18	24	20	22	12	4	—	1	1	—	40·8

From the above table the following points are to be noted :—

(1) The F_1 is practically at the arithmetic mean of the two parental strains. Previous investigations summarised in "The Genetics of

Gossypium," *Bibliographica Genetica*, v. ix–1932, indicate that long lint has usually been found to be dominant over short.

(2) In the first backcross 180 plants were grown with lint ranging from 33 to 49 mm. The majority of the plants were 40–44 mm. and the mean of the 180 plants was 40·8 mm., *i.e.*, somewhat above the mean of the original Ishan. It is noticeable, however, that only two plants are definitely of the F_1 length and it would thus seem that the number of genes responsible for the difference between Ishan and Sea Island is 7 or 8. With 8 genes the F_1 type should occur once in 256 times. The aim of the experiment however is not to transfer the whole of the lint length complex from Sea Island to Ishan, but only such part of it as seems commercially desirable.

In work of this kind it is necessary to select desirable plants from the first backcross and cross them again with Ishan. This procedure, however, has been found impossible under St. Vincent conditions since by the time the lint length examination is completed, on account of pests and diseases it is too late to make further crosses. Thus, if important work of this kind is to be pursued successfully, some kind of greenhouse accommodation is necessary.

Eighteen plants of the first backcross have been selected for various characters and will be grown in progeny rows next season. A backcross to the V.135 parent is also being studied.

The 28 selections of the selfed first backcross to Ishan with lint lengths of 44 mm. and over have been sent to the Director of the Nigerian Department of Agriculture for trial.

4. *Experiments with U.4 types containing the Asiatic red gene.*

Work at the Trinidad Station has shown that the cross New World (*G. barbadense L.* (Sea Island–Egyptian) × Asiatic Red flowered *G. arboreum* is partly fertile on the male side. As a result of repeated backcrossing to New World cottons, it has been found possible to transfer the red gene from Asiatic to U.4. A bulk sample of this material was sent from Trinidad and grown this year. The plants exhibited some remarkable features not previously seen in New World cottons, doubtless derived from Asiatic. Generally speaking, they were early maturing and very heavy yielders. All were immune from Angular Spot and some plants possessed lint length of above 45 mm. It will probably be possible to obtain out of this material some new synthetic combinations with valuable lint properties.

Seventeen selections for the individual characters of lint length (42–46 mm.), lint index (60–67 mg.), ginning % (38–39%), bolling (150–160) and hairiness will be grown in progeny rows next season.

5. *Experiments on seed storage.*

Information on the best conditions for storing seed in tropical countries is practically non-existent, and it was decided to institute a preliminary cold storage experiment. Sea Island cotton seed was kept (*a*) at ordinary room temperature *circa* 80°F. and (*b*) in cold storage at 22°F. Following are the results :—

Temperature.	*Percentage Germination.*									
	1.7.33	1.1.34	1.2.34	1.3.34	1.4.34	1.5.34	1.6.34	1.7.34	1.8.34	1.9.34
22°F.	97	91	95	86	85	80	86	71	63	*4
80°F.	97	77	66	54	44	43	48	42	27	11

* It has been found that the seed was interfered with and subjected to great fluctuations in temperature (rising sometimes to 35°F.).

6. *Miscellaneous.*

A large number of miscellaneous types were maintained in pure culture, including the combinations of U.4 with various other types. Crosses were successfully made between several New World types and the wild species *G. lanceæforme*. Observations were taken on resistance to Black Scale for further study next year.

FIJI

COTTON EXPERIMENT STATION, SIGATOKA, PROGRESS REPORT FOR THE SEASON 1933-34.

BY

R. R. ANSON.

Season.

The climatic conditions during the season were not at all favourable for cotton-growing. Early-planted cotton did not appear to suffer, but practically all seed planted after December failed miserably. This was caused by continuous showery weather which set in during January and continued intermittently right up until June. Out of two hundred and twelve days there were one hundred and nineteen upon which rain was recorded, which meant that during that period there were only ninety-three dry days, and even then the sky was for the most part overcast. The total rainfall for the year, however, was not excessive, amounting to 72·35 inches, which is fairly normal for these parts.

Cotton.

Late-planted cotton was stunted and weak and unable to resist the attacks of tip worm and jassid which consequently wrought havoc. Early-planted cotton, having set its bolls before either pest put in an appearance, did not suffer so badly.

The season has therefore emphasized the fact that early-planted cotton offers the best chance of obtaining profitable yields, and for the season 1934–35, cotton seed was made available early in October, thus enabling growers to get their cotton seed planted well before rice planting operations commence.

Varietal Tests.—Tests carried out with New Guinea×Sea Island backcrosses, Sea Island, Sakel, Sakel×Sea Island and New Guinea ×Sea Island second backcrosses, showed that in every case the New Guinea×Sea Island backcrosses more than doubled the yield of the control, Sea Island. Sakel, and Sakel×Sea Island, were practically equal to the control in yield. The highest yield obtained from backcrossed types was 1,219 lbs. of seed cotton per acre, while the control averaged 443 lbs. per acre.

In the present season these trials will be continued on a more extensive scale and plots will be set out on the Latin Square system which should give more significant results.

Fifty-one plants were selfed, three from each type, and seed from these has been planted out in progeny rows.

Spinning Tests.—The result of spinning tests which were very kindly made by the Peel Mills at Bolton, on seven bales of backcrosses, indicated that two of the backcross types were slightly superior in some respects to the control, a White Egyptian cotton from Casulli and Voltos seed known commercially as OXO quality.

The better of the two backcrosses tested has been multiplied up to commercial proportions and from three to four hundred acres will be planted with it in the season 1934–35. This should give it a thorough commercial test.

With a view to supplying a cotton equal to fine Egyptians, increase plots of second backcrosses are now being planted out and tested for yield against some of the Sakel×Sea Island types received from the Sudan. Small samples of lint from these second backcrosses will be forwarded in due course to the Shirley Institute for favour of spinning tests. In appearance the lint is finer and considerably stronger than that which was sent for testing on former occasions.

Brokers' reports.—The reports received from Messrs. Wolstenholme & Holland, on the seven bales described above, estimated the value of the best bales of Fiji backcross at 9·25 per lb., valuations having been based on Fully Good Fair Sakel at 8·35d. per lb. and May American futures at 5·92d.

Seed supply.—Increase plots, each of six acres, planted with types K3×S5–172 and K3×S5–24 were set out at the Cotton Station. The former has supplied sufficient seed to plant up an area of four hundred acres, and seed has now been distributed to agents for distribution to growers in this district. The latter will again be grown in progeny rows at the Cotton Station. Four hundred acres of the best Sea Island strain will be planted in the Lautoka and Ba districts and ginned separately.

Pests and Diseases.

Several plants of Shambur Sakel and Xh 1029 hybrid, received from the Sudan, were attacked by a form of leaf-curl, and in order to ascertain whether this was one and the same disease as is experienced on cotton in the Sudan and Nigeria, a coloured illustration showing the disease in its various stages was forwarded to the Corporation's Conference on

Cotton-growing Problems, held in London in July, 1934. Fortunately it was considered to be something quite different from that which is transmitted by white fly.

Jassid attack was most severe during March and did considerable damage to late-planted cotton. Tip worm (*Earias fabia*) was particularly active from February onwards. The Army worm (*Cirphis unipuncta*) damaged young tobacco plants but did not affect other crops to any great extent. Conditions were such that blackarm disease (*Bacterium malvacearum*) flourished and did considerable damage.

Rotation Crops.

The most successful rotation so far discovered in this Colony is Mauritius bean ploughed in at flowering-time and followed by maize and cotton.

In the past season maize, sweet corn and popcorn were grown with a certain amount of success, the highest yields obtained for maize being 60 bushels per acre.

Tobacco grown from seed of twelve imported varieties has been manufactured into cigars, 100 cigars having been made from each variety. The crop now harvested is of much better quality than that of last season, and is free from any trace of disease. Samples will in due course be sent to England for valuing.

Rice cultivation was again fairly successful, late maturing varieties gave the highest yields, the best being Motka which yielded 72 bushels per acre.

Pineapple terraces have been maintained although at present the outlook for the pineapple industry in the Colony does not look particularly bright.

Fijian Agricultural Instruction.

The Fijian Agricultural Instruction Scheme under my control with Mr. W. L. Parham, Assistant Agricultural Officer, in charge of supervision on the spot has progressed fairly favourably.

It was decided that the time had come when all individuals who had received instruction in modern agricultural methods on their consolidated blocks or centres should be settled on blocks of land of their own.

Arrangements were therefore made for the implements used during training at the centres to be divided amongst the men. It was realized that these men would still require guidance and supervision, and that a marketing organization was just as necessary in their case as it had been in the case of the training centres.

A committee consisting of the Provincial Commissioner, Officer in charge of the scheme, Assistant Agricultural Officer, native assistant to the Provincial Commissioner and the Buli (Head-man) from each district, was formed in order to guide, advise generally, discipline and control the efforts of men already trained. In order further to insure that a certain amount of discipline would be kept amongst these young students who were launching out on their own, arrangements were made for each community of settlers to be placed under the charge of a reliable and influential Fijian who might be either nominated by the committee or appointed by free choice of the individuals who were to work immediately under him, subject to the approval of the committee.

It is intended to carry on with two training centres only as it will now be impossible to continue the training of men at all the centres unless some additional provision is made for the supply of implements and staff.

The Government has now arranged that the existing advance of £500 shall be regarded as a continuous one ; all such natives as have implements advanced to them on credit are bound to sell all their produce through the departmental marketing organization, when 25% of the total proceeds of their crop is deducted and credited against their advances. The Officer in charge of the scheme, after having first obtained the consent of the Secretary for Native Affairs and the Director of Agriculture, is permitted to utilize all repayments made, for the purchase of additional requirements.

At present the crops grown are maize, cotton, tobacco, ground nuts, Mauritius bean and yagona. The question of markets is most difficult, and one which will be taken up by the new Director of Agriculture. The development of agriculture amongst the Fijians depends to a very large extent upon a remunerative price for a crop in quantity. The people are enthusiastic and good land is available.

The Cotton-growing Industry in Fiji.

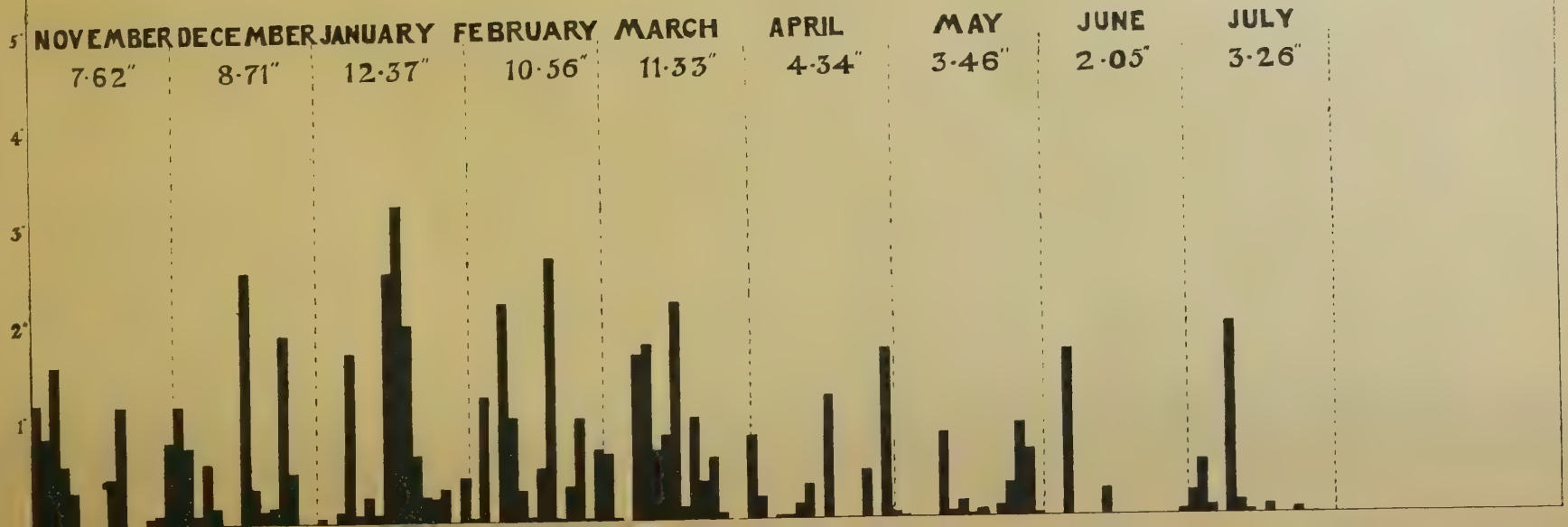
Two proposals have been considered in connection with the future of cotton-growing in Fiji :—(*a*) that the Government should continue with the breeding work at the Cotton Station without encouraging commercial cultivation, and (*b*) that this work should continue and at the same time a large-scale test of the new varieties be made. From what has been said above it will be seen that the latter proposal has been adopted. It must be anticipated, however, that for the first two or three years some loss will be sustained, due mainly to the high cost of freight.

In the season 1932–33, when the average price paid per pound of seed cotton was $1\frac{3}{4}$d., the grower received an average cash return per acre of £4. 6s. 9d., which is fairly satisfactory, although it falls short of the return from sugar growing. The sugar industry sets the standard of living of the Indian community in Fiji, and while the price of sugar remains at its present level, it is unlikely that Indians will be prepared to grow other crops at world prices unless induced to do so by necessity. Nevertheless, the sugar industry cannot absorb all the Indian community, so that a certain number will be forced to grow cotton, maize, rice, tobacco, etc., for their livelihood. Moreover, the Government may find it desirable to continue with the cotton work so as to have always available an alternative crop to sugar.

If it should be decided to encourage cotton-growing, it would be advisable to erect small receiving stations at places conveniently situated to consolidated areas. These receiving stations might feed the main forwarding and conditioning stations which would house ginning machinery. In order to bring down overhead expenditure, maize and paddy and perhaps a few other crops might be handled on a commission basis, with the ultimate object of handing the whole business over to commercial enterprise. A lorry attached to the main forwarding and conditioning station would make periodical visits to the receiving stations (galvanized iron sheds under the care of a neighbouring settler) to collect what produce had been deposited. In this way the same staff could be kept on throughout the year and by constant training they would naturally become more efficient and experienced. It would create a form of co-operative marketing amongst Indian farmers which up to the present has been non-existent in Fiji. Prices would be regulated by demand, and the danger of flooding markets would be lessened.

SIGATOKA EXPERIMENT STATION, FIJI.

RAINFALL—SEASON 1933-34 (IN 2 DAY TOTALS.)



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